NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

OAST SPACE THEME WORKSHOP

VOLUME III

WORKING GROUP SUMMARY

III. SENSORS (E-3)

A. STATEMENT

B. TECHNOLOGY NEEDS (FORM I)

C. PRIORITY ASSESSMENT (FORM II)

D. ADDITIONAL ASSESSMENT

HELD AT THE
LANGLEY RESEARCH CENTER
APRIL 26-30, 1976

SPONSORED BY NASA-CODE RX

Foreword

The attached material represents the working papers from the OAST Space Theme Workshop held at the Langley Research Center, April 26-30, 1976, and contains a quick-look analysis of the proceedings. The material is unedited and intended for further use by the participants of the workshop and the planning elements of NASA concerned with space mission research and technology. It should be understood that the data do not represent official plans or positions but are part of the process of evolving such plans and positions.

Nearly 100 of the Agency's top technologists and scientists joined with another 35 theme specialists to produce this working document - a document that provides a technical foundation, including research and technology base candidates, for each of the six space themes.

The material in this report is considered essential to the development of Center initiatives in support of these themes. Copies of the report will be made available to the Center Management Board and the individuals at the Centers responsible for the FY'78 program planning cycle. The timing of this planning activity has caused us to distribute this document in this unedited form. Thus, it possibly contains errors, hopefully, more of a typographical rather than a technological nature. Nonetheless, the information contained is of a high professional level, reflecting the efforts of the workshop participants and will be invaluable to the planning and successful execution of the Agency's near- and far-term advanced technology program.

Stanley R. Sadin
OAST Space Theme Workshop
Chairman
NASA Headquarters
Study, Analysis, & Planning Office
Office of Aeronautics and
Space Technology

SENSORS (WG E-3)

In Summary the Sensor WG finds the following with regard to:

Space Power - The sensor program would require new developments pertinent to instrumentation and calibration sensors in contrast to scientific sensors. One example is solar spectrum measurements for calibrating solar radiation.

Search for Extraterrestrial Intelligence - A new aspect of sensor technology requires the development of highly sophisticated receivers for narrowband detection of microwave signals. In addition, sensors for automated stellar cataloging must be developed for a mapping data base.

Solar System Exploration - The current sensor program would be significantly increased to respond to each need involved in the following phases of the exploration of the solar system.

1) Exploration from Earth Orbit - An increase in the development of large area solid state imaging arrays from ultraviolet to infrared.

2) Interplanetary Observation - An addition to the current program involving a long focal plane telescope using large solid-state imaging arrays from ultraviolet to infrared for synoptic planetary observation. (No specific sensor needs were identified for particles and fields sensors).

3) Sensing from Orbit - A new requirement was identified for high-energy particle detection from planetary surfaces to help characterize surface composition; new requirements in electromagnetic remote sensing were identified for visible, ultraviolet, and infrared detectors, and several advanced spectrometers to characterize planetary atmospheres and surfaces; and a need was introduced for a gravitometer to measure the mass distribution of the planets.

4) Atmospheric Probes - A new requirement was identified for an atmospheric distanalyzer.

5) Planetary In-Situ Surface Sensors - A need was identified for the development of sensors for penetrometers; a number of in-situ sensors were identified which require new technologies for surface chemical analyses, life detection, spectroscopic and microscopic analyses of surface soils, and meteorological measurements; and a new advanced technology for sample selection, handling, packaging, and return is recommended.

Global Service Systems - Three major areas were highlighted for support of the global service systems theme:

1) Development of advanced active and passive multi-application sensors for measuring atmospheric temperature profiles, water vapor, pressure, the presence of severe stroms, soil moisture, and ocean surface characteristics.

2) Advanced multi-spectral scanners which exploit the use of solid-state detectors to achieve improved resolution, sensitivity, spectral range, and reliability in the ultraviolet to infrared range.

3) Laser techniques to advance the state-of-the-art in atmospheric probing and oceanographic characterization.

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 1 OF 2

1. TITLE Alignment Sensing NO. 07.08/E3 / 1
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE
Provide physical allignment data for the assembly of large lightweight structures

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1983]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [ ]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [X] Flight Design (Check one or more)

f) R&T BASE CANDIDATE 50K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY None

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
Measurement accuracy within SOA. Technique to be applied must be chosen. A space qualified flight version must be developed.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 2 OF 2

TITLE Alignment Sensing NO. 08,07/E3/ 1

THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Measurement accuracy within SOA. Technique to be applied must be chosen.
A space flight qualified version must be developed.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Study			⊢	⊣																
Analysis				⊢	⊣															
Flight Design					⊢	⊣														
Grd Test						⊢	⊣													
Space Flt Test							⊢	⊣												
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Earth Based Arrays of 100-Meter Dish Antennas

NO. 1, 9 /E-3 2
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE
Improve signal-to-noise ratio by increased gain of receiving antenna

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [ ] FOR OPERATIONAL SYSTEM USE BY [DATE: 1985]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE funding level of 100K required FY 1978

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

There is no problem in building individual dishes with desired RMS tolerances or scanning several hundred dishes with desired mechanical accuracy. Hooking up these dishes and phasing them to play properly is, however, a problem. Components such as transmission lines, local oscillators, down converters, etc., must show high degree of stability.

1. STATE OF ART
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENTS
MATHEMATICAL MODEL
4. FEASIBLE FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD VALIDATED IN LABORATORY ENVIRONMENT
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. 1
PAGE 2 OF 2

TITLE Earth Based Arrays of 100 Meter Dish Antennas

NO. 4 9/E-3/ 2
THEME / W.G. / TASK

DATE 4 / 28/ 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Build identical dish antennas and array 1000 together to increase gain of receiving antenna.

7. ALTERNATIVE APPROACHES/OPTIONS

For earth based system, this technique seems to be the most viable.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

I believe the Structures Division at LaRC has submitted a new start for FY 78.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Design of Array		—	—																	
Fab/Construction				—	—	—	—	—												
Install Network						—	—	—	—											
Debug										—										
MANPOWER (M-Y) INHOUSE		2	2	300	300	400	400	400	100	10										
CONTRACT		10	10																	
FUNDING (10^6 $) INHOUSE		.1	.1	8	8	10	10	10	5	2										
CONTRACT		.5	.5							250										

SPACE TECHNOLOGY NEED — **FORM NO. 1**

1. TITLE UV/Visible/IR Imaging Arrays — NO. 10 / E-3 / 3 (THEME / W.G. / TASK)

DATE 4 / 28 / 76

2. OBJECTIVE To develop devices of high spacial resolution and broad spectral coverage.

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [ ] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1985]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [X] MEDIUM [ ] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [ ] RESEARCH [X] GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X] OTHER (Specify) [ ] _____ (Check one or more)

f) R&T BASE CANDIDATE _____

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. ICCD for hard UV (200 - 2000 Å)
2. Solid state array -- 200 x 200 (2000 - 4000 Å)
3. Large area, monolithic visual CCD
4. Optically mosaicked visual CCD's
5. Near IR area array
6. Thermal IR line array

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. 1
PAGE 2 OF 2

TITLE UV/Visible/IR Imaging Arrays

NO. 10 / E-3 / 3
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Develop Imager from 200 to 2000 Å
2. Develop Solid State Imager for 2000 to 4000 Å
3. Develop Large Monolithic CCD Visual Imager
4. Optically Mosaicked Large CCD Array
5. Near IR Area Array
6. Thermal Ir Line Array

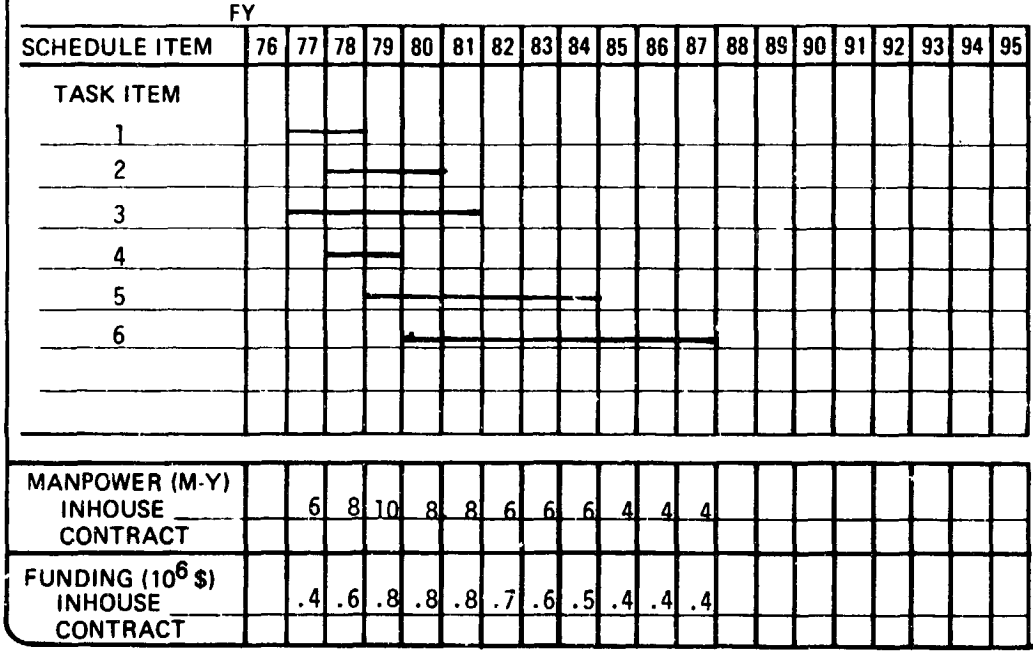
7. ALTERNATIVE APPROACHES/OPTIONS

None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES



SPACE TECHNOLOGY NEED — **FORM NO. 1**

PAGE 1 OF 3

1. TITLE Advanced Microwave Sounding Radiometers (Near-Nadir and Limb) — NO. 11 E-3 4 (THEME / W.G. / TASK)

DATE 4 / 26 / 76

2. OBJECTIVE

To provide near-all weather, high spatial resolution atmospheric sensing capability for temperature and water vapor profiling from geosynchronous orbit and stratosphere trace pollutant sensing from limb scanning low earth orbit

3. NEED ANALYSIS

a) LEVEL NOW [2], WILL BE LEVEL [3] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [XX] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [XX] ANALYSIS [X] RESEARCH [X] GRD TEST [X] AIR CRAFT TEST [XX] SPACE FLIGHT TEST [X] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 506-20-26 Millimeter Wave Component development (400K) New - 600K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY The required radiometric receivers (high efficiency) at 60 to 1000 GHz involve development of components, e.g., mixer, local oscillator, Multipliers. Large mechanically scanned (>10 m.D.) are required with momentum compensation.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Weighting functions, and data analysis algorithms need to be developed and demonstrated. Complementary operation with a multichannel IR radiometer (AASIR) should improve results. Dicke switch and correlation approaches traded off. The microwave limb sounder (MLS) was initiated under AAFE for frequencies below 300 GHz. The maximum sensitivity occurs near 1 THz. To operate efficiently at 1 THz, better mixers, multipliers and quasi-optical devices must be developed. The resultant receiver noise temperature must also be kept to less than 10,000° K in order for these submillimeter devices to offer an advantage over infrared instruments.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. 1

TITLE Advanced Microwave Sounding Radiometers (Near-Nadir and Limb)

NO. 11 E-3 4
THEME / W.G. / TASK

DATE 4/28/76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

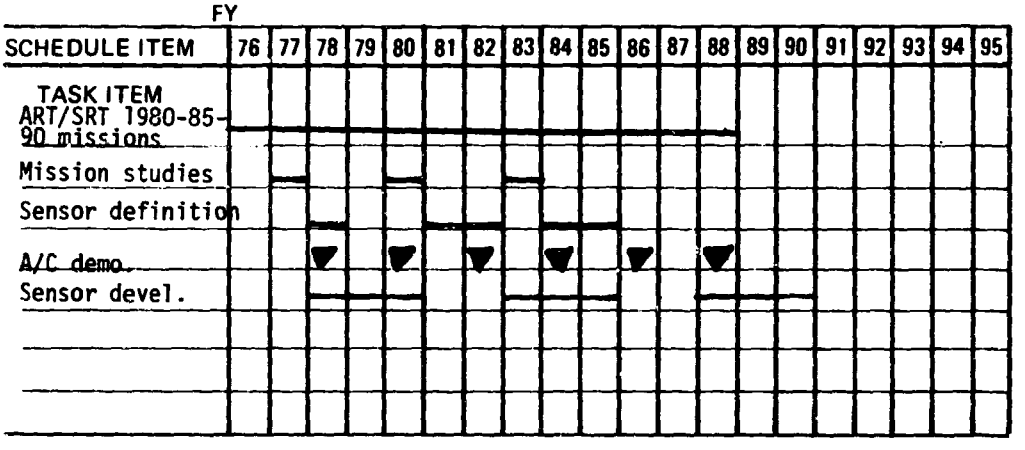
Perform ART/SRT for 1980-90 missions (Stormsat, shuttle) define, study, develop se-sors for 1985 and 1990 missions, carry-out ART/SRT in areas of science, weighting functions, receivers, components, feeds, antenna, momentum compensation on-board processing for inversion, required to achieve higher resolution and accuracy. Use A/C and ground demonstration of techniques.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Mixer, multiplier development initiated under UPN 506 and AAFE microwave limb sounder, directly relevant to stormsat and SEOS.

9. TECHNOLOGY SCHEDULES



	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
MANPOWER (M-Y) INHOUSE	3	3	3	3	3	3	3	3	3	3	3									
CONTRACT	.3	.4	.6	.6	.7	.7	.8	.8	.8	.1	.9	.8	.8	.8	.8					
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

1. TITLE Advanced Microwave Sounding Radiometers (Near-Nadir and Limb)

NO. 11/E-3 4
THEME / W.G. / TASK

DATE 4 / 28 / 76

( ) CONTINUATION (If Needed)
Block No.

will be required (13,000 wavelengths). The ability to fabricate and maintain radiometers to the required tolerance in orbit is a serious question. Development of electronically scanned arrays would be desirable since mechanical scanning of the large apertures is difficult. Improvement in oscillator and mixer performance extending to 1000 GHz is needed to provide reliable radiometer systems. Balanced gallium arsenide barrier mixers, gunn oscillators, and varactor multipliers must be developed to provide receiver systems over the complete range of frequencies.

SPACE TECHNOLOGY NEED

FORM NO. 1

1. TITLE Advanced Microwave Sounding Radiometers (Near-Nadir and Limb)

NO. 11/E-3 4
THEME / W.G. / TASK

DATE 4 / 28 / 76

( ) CONTINUATION (If Needed)
Block No.

will be required (13,000 wavelengths). The ability to fabricate and maintain radiometers to the required tolerance in orbit is a serious question. Development of electronically scanned arrays would be desirable since mechanical scanning of the large apertures is difficult. Improvement in oscillator and mixer performance extending to 1000 GHz is needed to provide reliable radiometer systems. Balanced gallium arsenide barrier mixers, gunn oscillators, and varactor multipliers must be developed to provide receiver systems over the complete range of frequencies.

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 1 OF 3

1. TITLE Advanced Multi-Frequency Microwave Imaging Radiometer NO. 11 E-3 5 THEME / W.G. / TASK

DATE 4 / 20 76

2. OBJECTIVE
To provide a high resolution atmosphere and ocean sensor to measure wind speed, salinity, sea temperature, sea state, ice, ocean pollution, clouds and precipitation for free flyers (both low orbit and synchronous)

3. NEED ANALYSIS

a) LEVEL NOW [4] WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [ ] RESEARCH [ ]
GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X].
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 506-20-26 (400K) New (600K)

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Multi-frequency feeds; large (up to 100 m) electronic and mechanical scanning antennas from 1 to 300 GHz; on-board processing of data analysis algorithms, low noise radiometer receivers

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Resolution and performance improvements over Nimbus G SCAMIR and the proposed shuttle imaging microwave systems for free flyer application. Development of mechanically scanned high gain (2-10 m) multiple beam antenna systems capable of operating over many octave bandwidths. Development of low noise radiometer systems with on-board microprocessor control and calibration suitable for direct to user transmission of microwave images. Development of large scanning arrays (up to 100 meters) operating at selected band (i.e., 1.4 GHz for soil moisture and salinity). The proposed microwave sounder for Stormsat (1981) will provide ~13 Km spatial resolution. Storm profiling at 5Km resolution or better will be required for 1990 missions. Since the highest frequency sounding bands are 118 GHz (oxygen) and 183 GHz (water vapor), this resolution can only be achieved by increasing antenna aperture dimension. Antenna dimensions of order 20 m

LEVEL OF STATE OF ART

1 - BASIC PRINCIPLES OBSERVED AND REPORTED
2 - THEORY FORMULATED OR CONCEPT PHILOSOPHY IN THE LABORATORY
3 - THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4 - BASIC FUNCTION OR CHARACTERISTIC DEMONSTRATED IN LABORATORY
5 - BASIC FUNCTION OR CHARACTERISTIC DEMONSTRATED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6 - MODEL TESTED IN AIRCRAFT ENVIRONMENT
7 - MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

TITLE Multi-Frequency Microwave Imaging Radiometer **NO.** 11 E-3 5
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

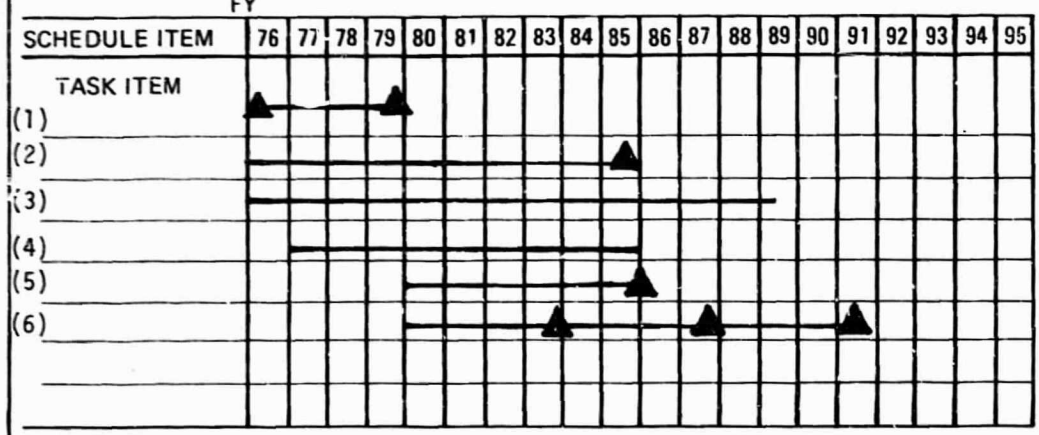
(1) Study alternate approaches for AMEMIR systems with high resolutions (1-10 Km IFOV)
(2) Develop microprocessor controlled low noise radiometer systems 1-300 GHz
(3) Fly aircraft missions with sets of systems and develop algorithms
(4) Develop 1-10 Km resolution shuttle MFMR system for demonstration experiments-Fly mission
(5) Develop free flyer MFMIR system with limited freq. coverage (low orbit)
(6) Extend frequency coverage and resolution to synchronous systems - fly missions

7. ALTERNATIVE APPROACHES/OPTIONS Parabolic torus with mechanically scanned feeds; mechanically scanned multiple reflector; mechanical and phased array systems in combination; synchronous vs low orbit;

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

SMMR on Nimbus G and SEASAT-A, SIMS and proposed SSMR for shuttle, ESMR on Nimbus 5 and 6, CV990 and WRB-57 A/C Experiments with MFMIRO, 175, 177 RTOP's, supporting ground based measurements

9. TECHNOLOGY SCHEDULES



	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
MANPOWER (M-Y)																				
INHOUSE	12	20	20	20	20	20	20	25	→											
CONTRACT	12	20	30	30	40	70	70	80	90	100	100	60	60							
FUNDING (10^6 $)																				
INHOUSE	.2	.5	.5	1	1	1	1	2	2	2	2	2	2							
CONTRACT	.6	1M	1M	25	35	5	5	6	6	7	7	5	5							

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 1 OF 2

1. TITLE Planetary Surface Chemical Analyses by Alpha-particle, gamma-ray and x-ray spectrometry

NO. 1-10 3E 6 (THEME / W.G. / TASK)

DATE 4 / 28 76

2. OBJECTIVE

Develop methods of spectrometric analysis for planetary surface study.

3. NEED ANALYSIS

a) LEVEL NOW [4] 5 WILL BE LEVEL [4] 5 UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY DATE: 1988

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X] GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 250K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Solid state detector with greater resolution and sensitivity.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Further develop technique and instrumentation of chemical analysis of solid surfaces by backscattering of alpha-particles from artifical radioactive source. Improve sensitivity, resolution, and extend capability to light elements.
2. Develop instrumentation for surface in-situ chemical analysis utilizing gamma and X-ray emissions induced on planetary surfaces by cosmic rays and energetic electromagnetic radiation.
3. Develop technique of remote activation analysis by means of a thermal neutron source.

Page 3 missing

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

TITLE Surface Chemical Analysis by Alpha-Particle, gamma-ray and X-ray spectrometry.

NO. 10 3E 6
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Development of flight qualified hardware, which can be used on planetary Landers and penetrometers.

7. ALTERNATIVE APPROACHES/OPTIONS

None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Post Viking studies by OSS.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Alpha particle spect.			├	─	─	─	─	─	┤											
X-ray spect.			├	─	─	─	─	─	┤											
gamma-ray spect.			├	─	─	─	─	─	┤											
neutron source			├	─	─	─	─	─	┤											
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Balloon Antenna 3 - 5 km Diameter

NO. 9/E-3 7
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE Spherical (half-alluminized) reflector antenna

3. NEED ANALYSIS

a) LEVEL NOW [7], WILL BE LEVEL [No] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT -- SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1990]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [X] MEDIUM [ ] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X] GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY structure rigid

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

(1) Space assembly to high degree of accuracy

(2) Free flying antenna feed

(3) Meteoroid penetration repair techniques

(4) Inflation techniques

LEVEL
1 STATE OF ART

1. CONCEPT OR APPLICATION FORMULATED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. EXPERIMENTAL FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

TITLE Balloon Antenna NO. 09 F3 7
THEME / W.G. / TASK

DATE 4 /28 /76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

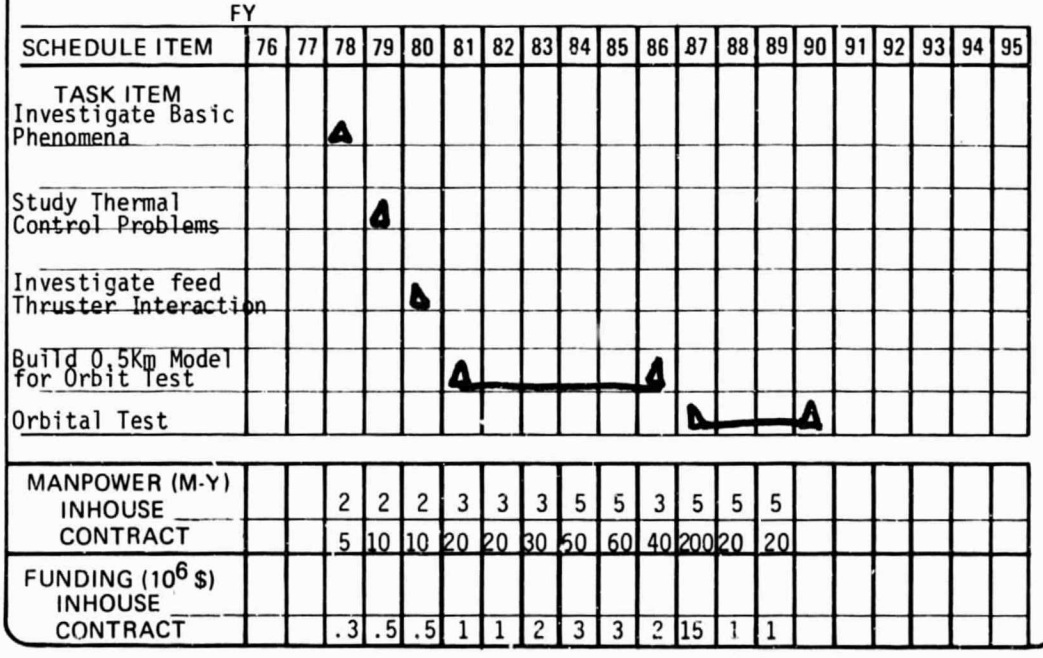
Examine experience on Echo program. Investigate in orbit assembly techniques. Study thermal control problems. Investigate feed movement thruster interaction. Building 0.5Km Dia model for low earth orbit test.

7. ALTERNATIVE APPROACHES/OPTIONS Rigid Antennas

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES



SPACE TECHNOLOGY NEED

FORM NO. I

PAGE 1 OF 2

1. TITLE Charge State Measurement

NO. 08,07 / E3 8
THEME / W.G. / TASK

DATE 4 /26 /76

2. OBJECTIVE

Determine charge state of storage cells.

3. NEED ANALYSIS

a) LEVEL NOW [7], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY DATE: 1980

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [ ]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [X] Rework for future requirements (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY None

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Rework present flight design for higher currents.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

PAGE 2 OF 2

TITLE Charge State Measurement — NO. 08,07/E3/ 8 (THEME / W.G. / TASK)

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Rework present flight design for higher currents.

7. ALTERNATIVE APPROACHES/OPTIONS Design new instrument.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Analysis			H																	
Rework			H	—	H															
Space Flt Test					H															
MANPOWER (M-Y)																				
INHOUSE			.1	.1	.1															
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT			.2	.3	.2															

SPACE TECHNOLOGY NEED

FORM NO. I

PAGE 1 OF 2

1. TITLE Radiation Dosage Meter

NO. 07,08/E3 9
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE Provide information to correlate solar cell performance with expected degradation from cumulative radiation. Provides warning of approaching end of life.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY DATE: 1980

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR
ENHANCING: HIGH [ ] MEDIUM [ ] LOW [X]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [X] Flight Design (Check one or more)

f) R&T BASE CANDIDATE $200K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY None

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Develop flight qualified of measuring equipment that is well within the SOA.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 2 OF 2

TITLE Radiation Dosage Meter NO. 08,07/E3 9

THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Choose most applicable ground based technology and develop flight qualified meter.

7. ALTERNATIVE APPROACHES/OPTIONS Don't use.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Study			H																	
Analysis			H																	
Research			H																	
Flight Design			H	H																
Grd Test				H	H															
Space Flt Test					H	H														
MANPOWER (M-Y)																				
INHOUSE			1	1	1															
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT			.2	.7	.6															

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. 1**

PAGE 1 OF 2

1. TITLE Development of Large Parabolic Torus Antenna

NO. 9/E3 10
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE

To build a reflector antenna which utilizes a simple feed design for scanning

3. NEED ANALYSIS

a) LEVEL NOW [5], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1995]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Spherical reflectors utilizing line source feed

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

A breadboard model has been developed to accommodate feeds for microwave radiometers for earth viewing experiments from space. Undoubtedly, this configuration will fly from space in a scanning mode. Feed scanning will be required for large reflector antennas in space.

SPACE TECHNOLOGY NEED FORM NO. I

TITLE Development of Large Parabolic Torus Antenna NO. 9/E-3/ 10
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Utilize the on-going research in earth viewing microwave radiometers to obtain optimum design. When the configuration is acceptable from the electrical standpoint, attack the structural problem of constructing a large array. Also flight test 3m dish in shuttle with microwave radiometers.

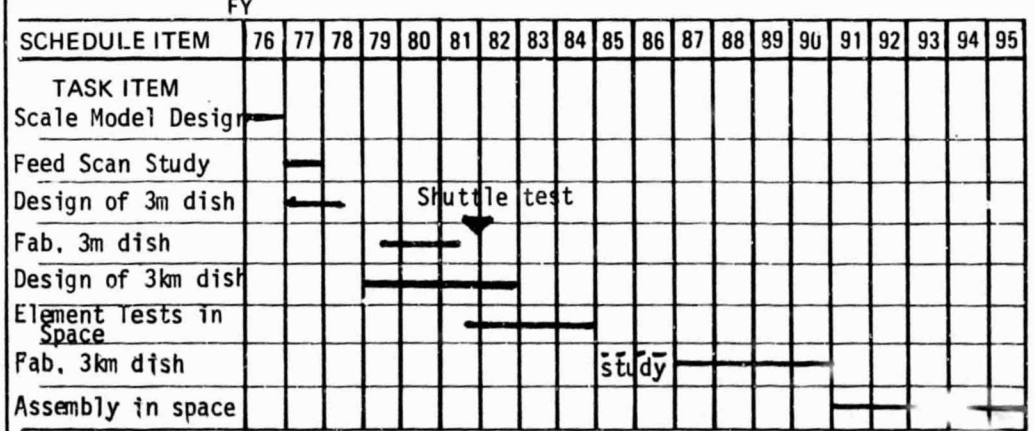
7. ALTERNATIVE APPROACHES/OPTIONS

Large spherical reflector with adaptive line source feed, or array of link source feeds.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Work has been done for SIMS and is planned for the Atmospheric Sensing Module.

9. TECHNOLOGY SCHEDULES



	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
MANPOWER (M-Y) INHOUSE	2	2	2	4	4	4	4	2	2	2	2	300	300	300	300	600	600	600	600	600
CONTRACT		2	4	14	20	30	30	20	20	10	10	Some	Some	Some	Some	Some	Some	Some	Some	Some
FUNDING (10^6 $) INHOUSE	.1	.1	.1	.2	.2	.2	.2	.1	.1	.1	.1	10	10	10	10	30	30	30	30	30
CONTRACT		.1	.2	.7	1.0	1.5	1.5	1.0	1.0	.5	.5	500	500	500	500	Some	Some	Some	Some	Some

SPACE TECHNOLOGY NEED **FORM NO. 1**

PAGE 1 OF 2

1. TITLE Collection Capabilities for Remote Sample Return

NO. 1-10 E-3 11
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE Develop capability to selectively collect material on surface of planetary body.

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [1] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY DATE: 1982-1986

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 300K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

The following specific requirements are needed:

a. Bulk soil collection
b. Sieving capabilities, e.g., particle size selection of (0.2 - 2 cm)
c. Coring device
d. Separate atmosphere sample
e. Rover capability for sample collection

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 2 OF 2

TITLE Collection Capabilities for Remote Sample Return

NO. 10 E3 11
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

SR&T required to develop technology and equipment required to support collection, protection and containator prevention of sample. Need methods of collecting bulk sample, sieve sample, core sample, atmospheric sample and Rover capabilities. Rover should have limited analysis and collection capabilities.

7. ALTERNATIVE APPROACHES/OPTIONS

OSS has supported preliminary Post Viking studies - SR&T is now required to develop technology.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM Sample collection																				
Bulk sample		—	—	—	—	—	—													
Sieve sample		—	—	—	—	—	—													
Coring device		—	—	—	—	—	—													
Atmosphere		—	—	—	—	—	—													
Rover				—	—	—	—	—	—	—	—									
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

LEVEL OF STATE OF ART

1 BASIC PHENOMENA OBSERVED AND REPORTED
2 THEORY FORMULATED TO DESCRIBE PHENOMENA
3 THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4 PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5 COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6 MODEL TESTED IN AIRCRAFT ENVIRONMENT
7 MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

PAGE 1 OF 2

1. TITLE SMALL PARTICLE (DUST) COMPOSITION ANALYZER — NO. 10/E-3/114 THEME / W.G. / TASK

DATE 4 / 28 / 75

2. OBJECTIVE

Develop a dust compositional analyzer for airborne particles (aerosols), cometary particles, planetary atmospheric dust.

3. NEED ANALYSIS

a) LEVEL NOW [1]. WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY DATE: 1985

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X] GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Spectral Data Analysis and Compression

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Need to develop a high-speed "decomposer" (e.g., laser zapper) and a broad range, high-speed mass analyzer. Most difficult problem is comet dust because of high input velocity.

Could be adapted to clean room usage.

SPACE TECHNOLOGY NEED — **FORM NO. I**

PAGE 2 OF 2

TITLE Small Particle (Dust) Composition Analyzer — NO. 10 / E-3 / 11A (THEME / W.G. / TASK)

DATE 4 / 28/ 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Select candidate decomposers
2. Select candidate analyzers
3. Perform component tests
4. Design Instrument
5. Fab. and Test Instrument
6. Perform science tests

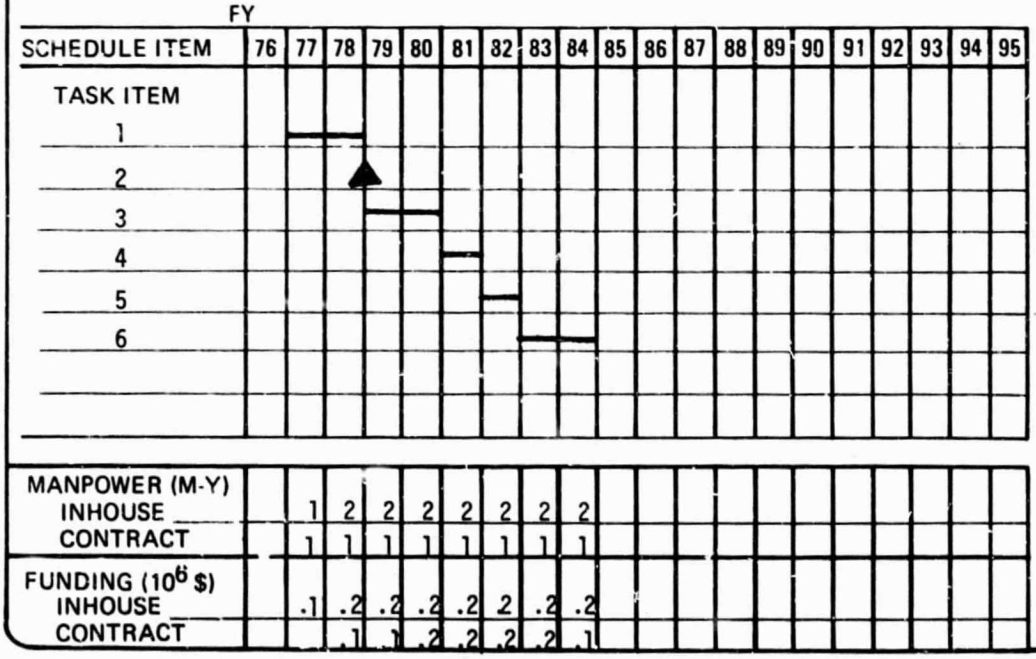
7. ALTERNATIVE APPROACHES/OPTIONS

None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES



SPACE TECHNOLOGY NEED FORM NO. I

PAGE 1 OF 2

1. TITLE Microwave Pressure Sensor NO. 1, 11 /E-3/ 13
THEME / W.G. / TASK

DATE 4 / 26 76

2. OBJECTIVE
To provide a global surface pressure sensor from low earth orbit at an accuracy of 1.5 mb. (0-15 percent)

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [ ] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [3] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE New (300K)

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Development of 600 MHz bandwidth radar altimeter for improved accuracy advanced system

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
A two spacecraft pressure sensing technique is under study (SRT). Preliminary results indicate that 3 mB accuracy can be achieved with 300 MHz seasat A-type altimeters. Propagation, geoid scattering uncertainties may limit the accuracy achievable. Techniques should be investigated to bound each contributing effect.

LEVEL OF STATE OF ART
1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

TITLE Microwave Pressure Sensor NO. 11 E-3 13
THEME / W.G. / TASK

DATE 4/27/76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

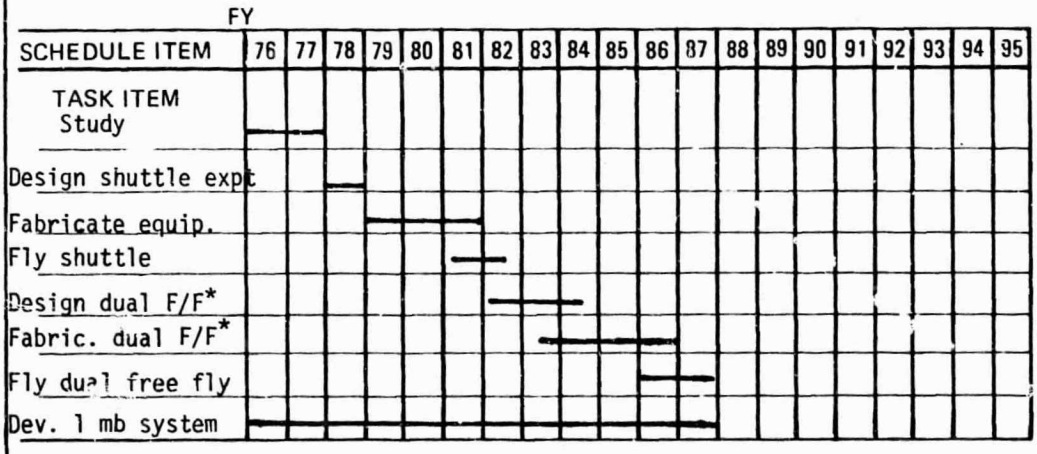
Complete study of dual spacecraft system (accuracy = 3 mb) based on seasat-A radar altimeter. Design shuttle exp't. deploying daughter spacecraft from Spacelab. Use results of spacelab exp't to design/fly dual S/C free flyer. Develop subsystems for 1 mb accuracy system.

7. ALTERNATIVE APPROACHES/OPTIONS A multi-channel 53 GHz transmissometer radar suggested by Peckham (Watt-Heriot Univ, active MW wkshop) proposed for 1978 SRT is an alternate candidate approach. Dual frequency 53 GHz transmitter/receiver development will be required.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Feasibility study initiated under 175 UPN in FY-76

9. TECHNOLOGY SCHEDULES



	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
MANPOWER (M-Y) INHOUSE	1	1	2	2.5	3	5	4	3	3	3	3	4								
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT	.02	.1	.3	.5	2.5	4	1	1	3	3	2									

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 1 OF 2

1. TITLE Multi-Function
Multi-Frequency Multi-Polarization
Microwave Radar

NO. 11 E-3 14
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE

To combine in a single sensor multiple mode capability of a radar altimeter, radar scatterometer and imaging radar for multi-discipline free flyers (land, oceans, ice)

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1983]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [ ]
GRD TEST [ ] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE New (500K)

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Data handling techniques for very high rates are needed along with data processing (possibly onboard). Data compression or selection is definitely required for real-time applications.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

An integrated active sensor of this class is technically feasible but requires development of multiplexed exciter and signal processor functions. Multi-frequency radar systems that are calibratible are needed so that accurate power vs time measurements can be made. Antenna characteristics must be accurately known so that all microwave information can be correlated with the scene and the other more conventional wavelenths. Co-registration with advanced multi-spectral V/IR scanners with improved sensing ability. Precision calibration is needed for accurate radar cross section determination

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

TITLE Multi-Function Multi-Frequency Multi-Polarization Microwave Radar

NO. 11 E-2 14
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

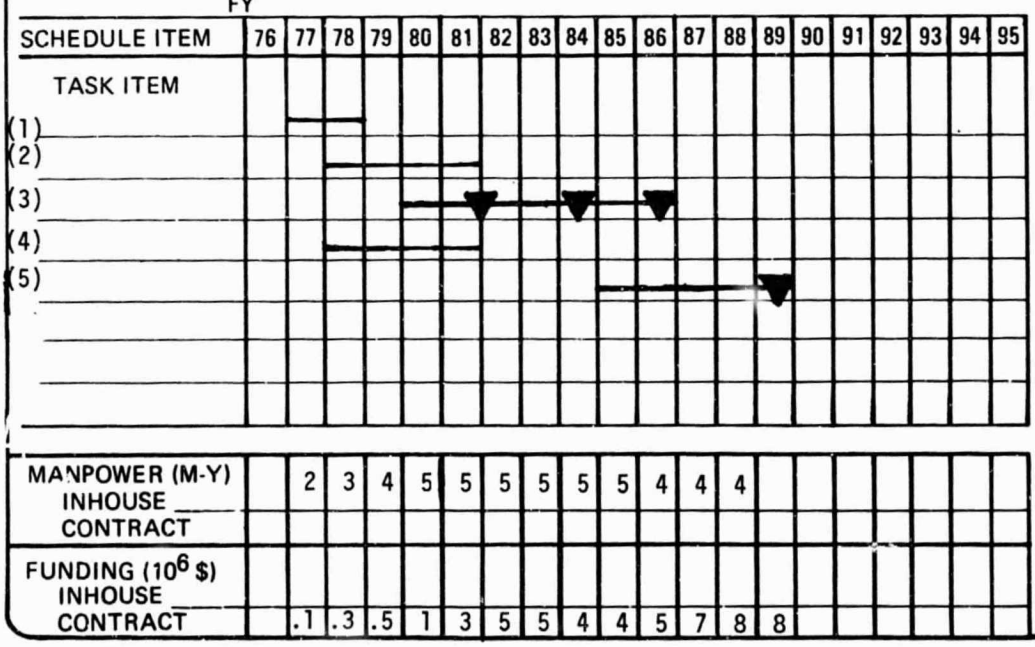
(1) Perform study to define sensor meeting earth/ocean applications needs.(2)ART/SET critical subsystems (3)Develop and fly on shuttle sensor elements for checkout of multi-mode operation. (4) Develop techniques for on-board processing to obtain ocean spectra, pattern analysis, radar cross section, altitude.(5)Develop free flyer sensor

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

SEASAT-A, shuttle, TDS imaging radars; SRT 161, 369, 645, 683, 177 programs

9. TECHNOLOGY SCHEDULES



	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
MANPOWER (M-Y)		2	3	4	5	5	5	5	5	5	4	4	4							
INHOUSE																				
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT		.1	.3	.5	1	3	5	5	4	4	5	7	8	8						

SPACE TECHNOLOGY NEED **FORM NO. 1**

PAGE 1 OF 2

1. TITLE High Resolution Imaging Spectrometer NO. 10 E-3 15
THEME / W.G. / TASK

DATE 4 /26 / 76

2. OBJECTIVE

To permit selectable spectral filtering for multiple pushbroom imager

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [ ] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] _____ (Check one or more)

f) R&T BASE CANDIDATE _____

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Imaging spectrometer
2. Area imaging arrays from near UV to near IR

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. 1
PAGE 2 OF 2

TITLE High Resolution Imaging Spectrometer NO. 10 / E-3 / 15
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Perform Con ceptual Design and MTF Analysis
2. Detailed Optical Design
3. Spectrometer Fab and Test
4. Integrate with Sensor Array
5. Field Testing

7. ALTERNATIVE APPROACHES/OPTIONS

None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
1		—																		
2		—																		
3			—																	
4				—																
5					—															
MANPOWER (M-Y) INHOUSE		3	4	5	3															
CONTRACT																				
FUNDING (10^6 $) INHOUSE		.1	.3	.4	.1															
CONTRACT																				

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 1 OF 2

1. TITLE Giga Channel (10^9) NO. 01,09 E-3 16
THEME / W.G. / TASK

Spectrum Analyzer

DATE 4 / 26 1976

2. OBJECTIVE

Breakdown Received Bandwith into 10^9 Components for Improved S/N

3. NEED ANALYSIS

a) LEVEL NOW 1, WILL BE LEVEL 5 UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1985]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [X] MEDIUM [ ] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [H] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 250K in FY78

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

- Packaging
- Matching Software

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. 1
PAGE 2 OF 2

TITLE Giga Channel (10^9) Spectrum Analyzer

NO. 1,09/E-3 16
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Build 10^6 Multi Channel Spectrum Analyzer and build up capability gradually for 10^9 MCSA capability by 1986

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	94	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Computer Simulation	◆																			
10^6 MCSA Construction		◆	◆																	
10^9 Prelim. Design			◆	◆																
10^9 Module Test				◆	◆															
10^9 MCSA Construction and test						◆	—	—	—	—	◆									
MANPOWER (M-Y) INHOUSE	1	1	2	2	2	1	1	1	1	1	1									
MANPOWER (M-Y) CONTRACT		1	4	6	6	6	5	5	3	2	1									
FUNDING (10^6 $) INHOUSE	.05	.05	.1	.1	.1	.05	.05	.05	.05	.05	.05									
FUNDING (10^6 $) CONTRACT		.05	.2	.25	.5	1	2	3	.5	.25	.1									

SPACE TECHNOLOGY NEED

FORM NO. I

PAGE 1 OF 2

1. TITLE Solar Spectrum Measurement

NO. 08,07 E3 17
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE

Provide information to correlate expected solar cell performance with actual incident solar irradiation in the IR to UV spectrum.

3. NEED ANALYSIS

a) LEVEL NOW [7], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1980]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [X]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [ ]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [X] Rework for application (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY None

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Rework present flight instrumentation to suit application.

LEVEL OF STATE OF ART

1. BASIC PRINCIPLES CLASSIFIED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

PAGE 2 OF 2

TITLE Solar Spectrum Measurement

NO. 07,08 /E3 17
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Rework present flight instrumentation to suit application.

7. ALTERNATIVE APPROACHES/OPTIONS Dont use.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	66	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Analysis			H																	
Rework			H	H	H															
Space Flt Test					H															
MANPOWER (M-Y)																				
INHOUSE			.1	.1	.1															
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT			.2	.3	.2															

SPACE TECHNOLOGY NEED

FORM NO. 1
PAGE 1 OF 12

1. TITLE Portable Hazard Warning Detector for Microwave and LASER Beams

NO. 07,08 / E3 / 18
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE
Provide warning of hazardous radiation in Microwave and LASER regions for astronaut protection.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1985]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [X] Development (Check one or more)

f) R&T BASE CANDIDATE 200K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY None

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
Low power, light weight LASER and microwave detection sensors and electronics. Packaging and placement of detector such as to not interfere with human activities in space.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. 1
PAGE 2 OF 2

TITLE Portable Hazard Warning Detector for Microwave and LASER Beams

NO. 07,08/ E3 18
THEME / W.G. / TASK

DATE 4 /28 /76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Study hazard and define detection requirements.

Analyze detector physical configuration.

Research human interface techniques.

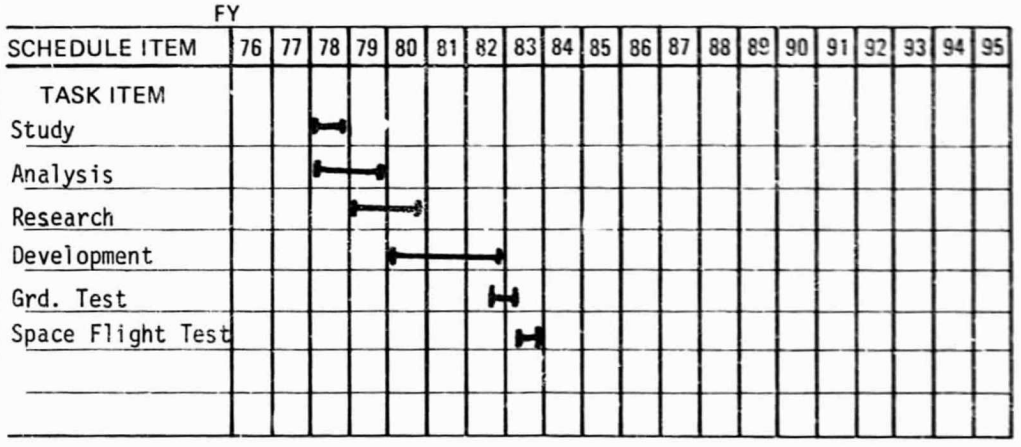
Develop integrated detector, analyzer and warning system.

7. ALTERNATIVE APPROACHES/OPTIONS Accept risk of microwave or LASER exposure and drop hazard warning requirement.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES



	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
MANPOWER (M-Y)																				
INHOUSE			.5	.5	.5	.5	.5	.5												
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT			.2	.2	.3	.4	.4	.3												

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Low Noise Microwave Receivers

NO. 1.9/E-3/6 19
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE
Improve S/N Performance

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL 5 UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1981]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR
ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] _____ (Check one or more)

f) R&T BASE CANDIDATE FY78 $300

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

(1) MASER & MASER component improvements from 5-10 Kelvin to 2 Kelvin

(2) Improved bandwith to 1.0 GH_z

(3) Investigation of alternative receivers such as Josephenson junction detectors.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED — PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. I
PAGE 2 OF 2

TITLE Low Noise Microwave Receivers

NO. 1,9/c-3 19
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Improve MASERS and associated components (such as circulators) to reduce receiver noise from 5 - 10 Kelvin to 2 Kelvin. Also extend bandwidth in travelling wave MASERS to 1.0 GHZ, while lowering the noise. Improve fabrication techniques for superconducting junctions.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES

FY / SCHEDULE ITEM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Study Contract			—	—																
Component Development					—	—	—													
MASER Improvements							—	—	—											
Superconducting Devices					—	—	—	—												
MANPOWER (M-Y) INHOUSE			2	2	4	4	4	4	2											
CONTRACT			4	4	4	4	6	4	2											
FUNDING (10^6 $) INHOUSE			.1	.1	.2	.2	.2	.2	.1											
CONTRACT			.2	.2	.2	.2	.3	.2	.1											

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Penetrator Sensor Development NO. 10/E-3/2D
THEME / W.G. / TASK

DATE 4 / 27 / 76

2. OBJECTIVE Develop sensors which reasonably can fit within a penetrator payload.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [6] FOR OPERATIONAL SYSTEM USE BY [DATE: 1985]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE Yes

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Microelectronics Capable of Withstanding High G-Loading

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Develop low data rate, small sensors capable of withstanding high landing impact shock. Sensors include:

Seismometer
Accelerometer
α - Scattering spectrometer } Partially developed
Anemometer
Volatile Profilometer (e.g., measure permafrost)

SPACE TECHNOLOGY NEED FORM NO. I

TITLE Penetrator Sensor Development NO. 10/E3/20
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Develop miniature sensors capable of withstanding high decelerations. Sensors include seismometer, accelerometer, α-scattering spectrometer, anemometer (and other meteorological sensors), profilometer for volatile materials, thermal diffusivity.

7. ALTERNATIVE APPROACHES/OPTIONS None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Military developments should be reviewed

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Engineering study			—	—																
Sensor development				—	—	—	—													
Sensor integration							—	—	—											
System test									—	—										
MANPOWER (M-Y) INHOUSE			2	2	2	2	4	4	4	2										
CONTRACT			4	8	8	12	16	12	8	8										
FUNDING (10^6 $) INHOUSE			50	50	50	50	100	100	150	50										
CONTRACT			100	200	200	300	400	300	200	200										

SPACE TECHNOLOGY NEED — **FORM NO. 1**

PAGE 1 OF 2

1. **TITLE** Differential Correlation Radiometry for Tropospheric Pollution Profiling and Gas Filter Radiometry for Stratospheric Pollution Profiling Using Solar Occultation

NO. 11/E-3 2W
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. **OBJECTIVE**

To measure vertical pollution profiles on a global basis for a large number of important tropospheric and stratospheric species with a detection sensitivity in the part per billion range.

3. **NEED ANALYSIS**

a) LEVEL NOW [4], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ] (DCR)

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR [X] ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]
GFR

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] _____ (Check one or more)

f) R&T BASE CANDIDATE _____

4. **COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY** Gas cell technology development, coating uniformity, solar pointing technology, and on-board data management.

5. **SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED**

Nadir viewing vertical profile for tropospheric and lower stratospheric, including boundary layer and limb profiles for statosphere.

Advanced optical design for direct measurement of differential absorbtion with a single detector, single aperture system in the reflected solar spectrum with a S/N ratio of several thousand.

Improved radiometric stability per limb-solar occultation measurement and extension to additional compounds (i.e., bromine)

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

TITLE Differential Correlation Radiometry for Tropospheric Pollution Profiling and Gas Filter Radiometry for Statospheric Pollution Profiling Using Solar Occultation

NO. 11/E-3 2/ THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Develop advanced Differential Correlation Radiometer based on SRT-field model DCR, for aircraft and spacelab flight test and demonstration

Extend development of Solar Occultation Limb Experiment - Δ new AAFE start, to bramine and ? species.

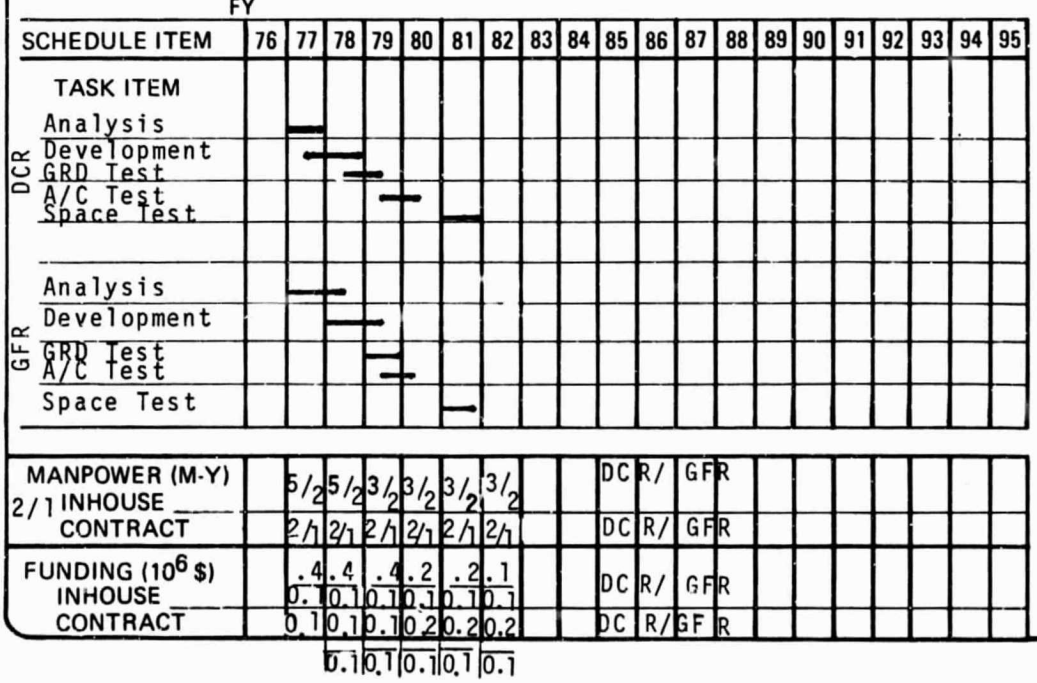
7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Differential Correlation Radiometer - 176-21-41

Solar Occultation - Gas Filter Radiometer - AAFE-638

9. TECHNOLOGY SCHEDULES



SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Laser Heterodyne Radiometry

NO. 11 /E-3/ 22
THEME / W.G. / TASK

DATE 4 /26 / 76

2. OBJECTIVE
To develop radiometer with improved spectral resolution and tunable spectral bandpass for atmospheric constituent measurements

3. NEED ANALYSIS

a) LEVEL NOW [5], WILL BE LEVEL [6] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1981]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Tunable laser diodes for LO's - Improved detector refrigerators

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

→ Tunable laser diodes for use over spectral regions between 1.0 and 25 μm; and which have long operating lifetimes and high spectral stability.

→ Total system development and testing.

→ Additional error analyses for effects of atmospheric interferrants and parameter variations on measure.

SPACE TECHNOLOGY NEED — **FORM NO. I**

TITLE Laser (Passive) Heterodyne Radiometry

NO. 11 E-3 22
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

a. Flight instrument development, limited turnability & atm species underway underway.
b. Aircraft test of simple instrument
c. Define/develop experiment for shuttle spacelab payload; flight test first opportunity.
d. Develop tunable lasers with wider range turnability (1-25) and more species.
e. Error analyses - effects of interferrants & parameter variations.
f. Define/develop wide spectral range, multi-species experiment for spacelabe flight test at first opportunity.

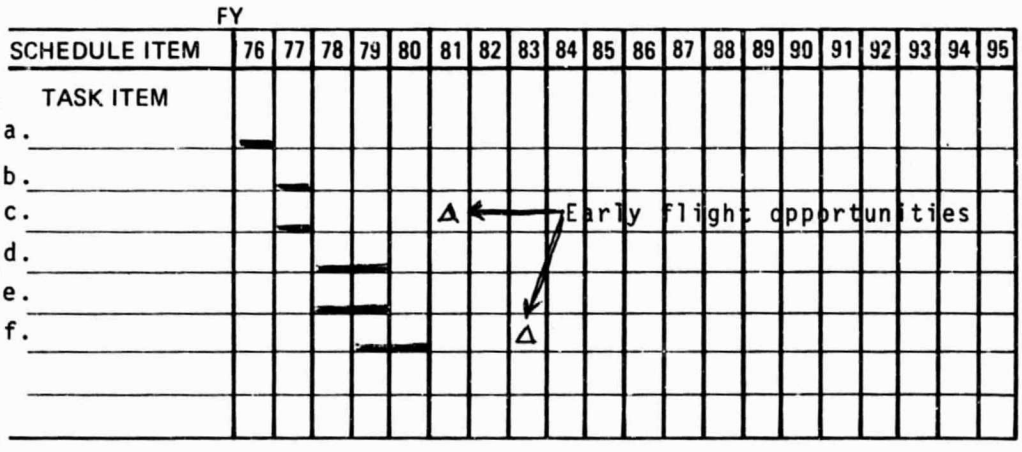
7. ALTERNATIVE APPROACHES/OPTIONS

Passive IR Filter Radiometry

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER) 506-18-12

506-18-12 - Basic SR&T
AAFE - Item a and b
750-01 & 03 - Item 3 (New initiative)

9. TECHNOLOGY SCHEDULES



	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
MANPOWER (M-Y)																				
INHOUSE		12	18	20	20	15	15	7												
CONTRACT		2	3	3	3	2	2	—												
FUNDING (10^6 $)																				
INHOUSE		.1	.1	.1	.1	.1	.1	.1												
CONTRACT		.6	1.2	1.6	1.6	1.1	.8	2												

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2?

1. TITLE CONTAINMENT AND PROTECTION REQUIREMENTS OF REMOTE SAMPLE RETURN

NO. 1-10 E-3 23
THEME / W.G. / TASK

DATE 4 /26/ 76

2. OBJECTIVE

Specified containment and return of collected material to prevent degradation of scientific information

3. NEED ANALYSIS

a) LEVEL NOW [2], WILL BE LEVEL [2] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982-]1986

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [x] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [x] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [x] ANALYSIS [x] RESEARCH [x]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 100K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

A. Reliable vacuum sealing container constructed of non-contaminating material.

B. Monitoring and control of pressure, temperature and radiation environment during sample return

C. Receipt of sample on earth or near-earth environment.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. I
PAGE 2 OF 2

TITLE Containment and Protection Requirements of Remote Sample Return

NO. 10 E3 23
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

SR&T program of development of sampling devices and container which are vacuum tight - Container must be able to be sealed. Monitoring of temp. pressure and radiation environment from collection until analysis.

7. ALTERNATIVE APPROACHES/OPTIONS

None presently - post Viking studies - previously by OSS.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Vacuum container		⊢	—	—	—	—	⊣													
P,T Monitoring		⊢	—	—	—	—	⊣													
Radiation shielding		⊢	—	—	—	—	⊣													
Sample receipt					⊢	—	—	—	—	—	⊣									
MANPOWER (M-Y)																				
INHOUSE																				
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Design of Suitable Line Sources for Spherical Reflectors

NO. 19/E-3 24
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE
Develop a line source (or array of line sources) suitable for wide angle feed scanning of spherical reflector antenna

3. NEED ANALYSIS

a) LEVEL NOW 1 , WILL BE LEVEL 5 UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL 7 FOR OPERATIONAL SYSTEM USE BY DATE: 1995

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] _____ (Check one or more)

f) R&T BASE CANDIDATE funding level of $100K required FY 78

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY a parabolic torus reflector will not require a line source.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
An advanced line source feed has recently been installed in arecibo; however, to my knowledge, the feed is fixed (to within a few beam-widths) while the reflector scans due to earth's rotation. For a large spherical reflector in space, wide angle scanning would be highly desirable (probably mandatory) by moving the feed rather than the big dish. To scan more than a few beamwidths, control over the amplitude and phase distribution of the feed is required. This implies either an adaptive feed or an array of feeds.

LEVEL
1. BASIC PRINCIPLES OBSERVED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

STATE OF ART

SPACE TECHNOLOGY NEED

FORM NO. I
PAGE 2 OF 2

TITLE Design of Suitable Line Sources for Spherical Reflectors

NO. 19/E-3/24
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Initiate theoretical studies to either (1) build an adaptive feed to Taylor the amplitude and phase to maximize the reflector efficiency as a function of feed location and/or (2) to build an array of line sources to maximize the same.

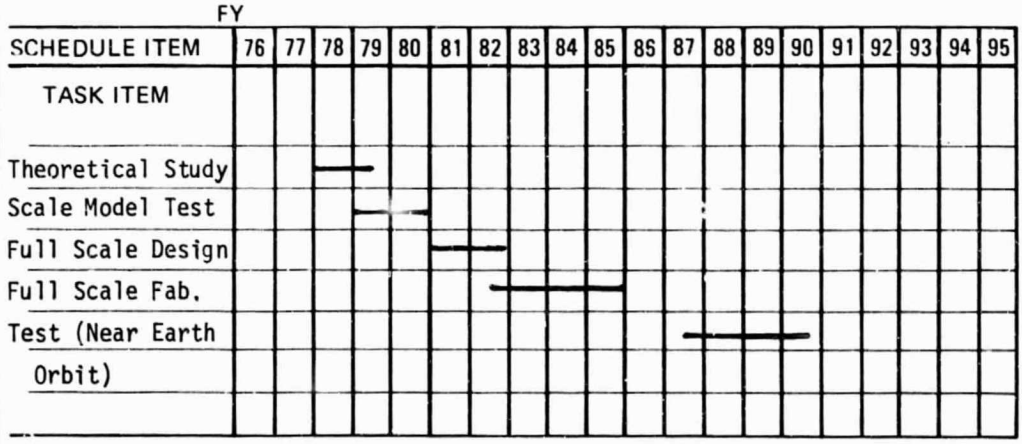
7. ALTERNATIVE APPROACHES/OPTIONS

Construct a parobolic Torus reflector that does not utilize a line source.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES



	78	79	80	81	82	83	84	85	86	87	88	89	90
MANPOWER (M-Y) INHOUSE	2	2	2	2	4	4	4	4	4	4	6	6	4
CONTRACT	2	4	4	10	20	20	20	20		10	20	20	10
FUNDING (10^6 $) INHOUSE	.1	.1	.1	.1	.2	.2	.2	.2	.2	.2	.3	.3	.2
CONTRACT	.1	.2	.2	.5	1	1	1	1		.5	1	1	.5

SPACE TECHNOLOGY NEED

FORM NO. I

PAGE 1 OF 2

1. TITLE Magnetic Sensing

NO. 07,08/E3 25
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE

Determine fields created by low voltage, high current power distribution system in anticipation of deleterious effects upon platform users.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1980]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR
ENHANCING: HIGH [ ] MEDIUM [ ] LOW [X]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [ ]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [X] Flight Design (Check one or more)

f) R&T BASE CANDIDATE 200K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY None

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Develop a space qualified flight version of nominal ground instrumentation.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. I

PAGE 2 OF 2

TITLE Magnetic Sensing

NO. 08,07 / E7 / 25
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Develop a space qualified flight version of nominal ground instrumentation.

7. ALTERNATIVE APPROACHES/OPTIONS Don't use.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Flight Design			⊢	⊣																
Grd Test			⊢	⊣																
Space Flt Test				⊢	⊣															
MANPOWER (M-Y)																				
INHOUSE			.1	.2	.2															
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT			.2	.8	.7															

SPACE TECHNOLOGY NEED

FORM NO. I

TITLE Magnetic Sensing

NO. 08,07 / E7 / 25
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Develop a space qualified flight version of nominal ground instrumentation.

7. ALTERNATIVE APPROACHES/OPTIONS Don't use.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Flight Design			⊢	—	⊣															
Grd Test				⊢	⊣															
Space Flt Test					⊢	⊣														
MANPOWER (M-Y)																				
INHOUSE			.1	.2	.2															
CONTRACT																				
FUNDING (10^3 S)																				
INHOUSE																				
CONTRACT			.2	.8	.7															

SPACE TECHNOLOGY NEED

FORM NO. I

TITLE Large Linear Multicolor CCD Arrays

NO. 1,09/E3 27
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Investigate size required for compatibility with existing or planned telescopes. Investigate overcoating techniques to obtain desired discrimination. Select optimum wavelengths for each of the five colors. Design software or microprocessor to be 100% compatible with sensor array.

7. ALTERNATIVE APPROACHES/OPTIONS Film readers

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Limited for multispectral scanners (Landsat type)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Investigate size required		▲																		
Select overcoating technique			▲																	
Build and test modular element				▲																
Fabricate operational array				▲	—	▲														
MANPOWER (M-Y)																				
INHOUSE																				
CONTRACT		2	6	6	4	2														
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT		.1	.3	.3	.2	.1														

SPACE TECHNOLOGY NEED **FORM NO. I**

1. TITLE Large Linear Multicolor CCD Arrays NO. 1, 09/E3 27
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE
Component of Smart Sensor to identify stars of correct spectral type for extra terrestrial intelligence investigation

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1980]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIRCRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] Sensor would operate on the ground (Check one or more)

f) R&T BASE CANDIDATE FY78 $250K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
Linear arrays with overcoated filters are required to make photometric measurements simultaneously in five or more colors. Such arrays would operate at the focal plane of conventional ground based optical telescopes. Data system would reject all but desired spectral classes and store type, and coordinates for later "listening" by radio telescopes.

LEVEL OF STATE OF ART

1 BASIC PHENOMENA OBSERVED AND REPORTED
2 THEORY FORMULATED TO DESCRIBE PHENOMENA
3 THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4 PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5 COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6 MODEL TESTED IN AIRCRAFT ENVIRONMENT
7 MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — FORM NO. I — PAGE 2 OF 2

TITLE 1500°K Temperature Sensing — NO. 08,07 / E3 / 26 (THEME / W.G. / TASK)

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Develop space qualified flight version of nominal SOA ground instrumentation.

7. ALTERNATIVE APPROACHES/OPTIONS Don't use.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Study			⊢	⊣																
Analysis			⊢	⊣																
Flight Design					⊢	⊣														
Space Flt Test						⊢	⊣													
MANPOWER (M-Y)																				
INHOUSE			.1	.1	.1	.1	.1													
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT			.1	.1	.1	.2														

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — FORM NO. I — PAGE 1 OF 2

1. TITLE Laser (Active) Absorption Spectrometry and Lidar — NO. 10;11/E-3/ 29 (THEME / W.G. / TASK) — DATE ___ / ___ / ___

2. OBJECTIVE To measure vertical profiles of atmospheric pollutants in the troposphere; and to measure productivity, turbidity, salinity, and depth of water. Also of value in planetary atmospheric studies.

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [ ] FOR OPERATIONAL SYSTEM USE BY [DATE: 1986]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X] GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Hi-Powered Tunable Lasers and Laser Diodes Detectors, Detector Cooler Technology; Data Management Laser Heterodyne

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

- Improved Radiometric and Spectral Stability
- Increase operable spectral range to cover 0.4 to 20 μm
- Analysis, development, and test to determine error effects of boresighting, variable backgrounds, and altitude
- Radiometric sensitivity to measure Raman and fluorescence resonance effects

SPACE TECHNOLOGY NEED **FORM NO. I**

PAGE 1 OF 2

1. TITLE Improved X-ray and γ-ray Remote Sensors for Planetary Surfaces

NO. 1-10 E-3 28
THEME / W.G. / TASK

DATE 4 / 27 / 76

2. OBJECTIVE

Develop improved X-ray and γ-ray detectors for remote orbital measurements of the composition of planetary surfaces.

3. NEED ANALYSIS

a) LEVEL NOW [5], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1983]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [x] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [x] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [x] RESEARCH [x]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 200K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

1. Solid state technology of solid state detectors
2. Cooling

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Develop greater spectral resolution of X-ray and γ-ray detectors for remote sensing.
2. Develop technology for greater surface spatial resolution for X and γ detectors in planetary orbit.
3. Develop more detailed understanding of calibration and interference problems with developed detectors (S, R and T)
4. Determine long term irradiation effects on detectors (SR&T)

LEVEL OF STATE OF ART

1 BASIC PHENOMENA OBSERVED AND REPORTED
2 THEORY FORMULATED TO DESCRIBE PHENOMENA
3 THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4 PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5 COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6 MODEL TESTED IN AIRCRAFT ENVIRONMENT
7 MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. 1
PAGE 2 OF 2

TITLE Improved X-ray and -ray Remote Sensors
Sensors for Planetary Surfaces

NO. 10 3E 28
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Use of high resolution, high sensitivity solid-state detectors required. Complimentary SR&T studies on detector performance, calibration, and limitations required.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

OSS previous support of Apollo flight instruments - of lower capabilities: Present plans for Lunar Polar Orbiter - and Planetary orbiter require development.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
X-ray		←	—	—	—	—														
γ-ray		←	—	—	—	—														
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. I

PAGE 1 OF 2

1. TITLE Spaceborne Meteorological Radar (Active Microwave Profiler)

NO. 1/11 /E-3/ 30
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE To map in 3-dimensions precipitating and nonprecipitating clouds and storms.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1981]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [ ] GRD TEST [ ] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE New (1.0 M)

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY High power space qualified transmitters at 3, 6, 10, 15, 30 GHz. Push-broom multiple beam antennas.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Precision wide swath multi-frequency coherent radars will generate extremely high data rates (800 Mbps). Either high data rate TDRSS link or on-board processing is required to handle this information. High measurement accuracy requires fixed beam radars. Multi-frequency fixed beam array antennas are required.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. 1

TITLE Laser (Active) Absorption Spectrometry and Lidar

NO. 10;11/E-3 29
THEME / W.G. / TASK

DATE ___ / ___ / ___

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

a. Analyses to define design requirements for important tropospheric pollutants, and evaluate meteorological error sources.

b. Design system to incorporate tunable laser diodes and high power lasers

c. Fabricate field system and perform ground and aircraft tests.

d. Design, fabricate, and test sensor system for Shuttle.

7. ALTERNATIVE APPROACHES/OPTIONS Passive IR sensors.

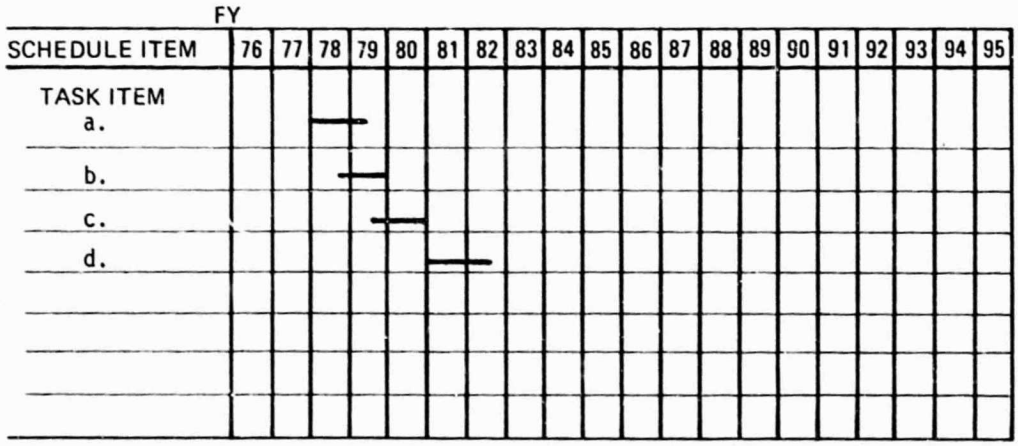
8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

506-18-12

506-18-15

AAFE developments for LAS, LHR, Meteor. and Ocean. Lidars

9. TECHNOLOGY SCHEDULES



SPACE TECHNOLOGY NEED **FORM NO. I**

PAGE 1 OF 2

1. TITLE Compositional Analysis of Small Solid Particles

NO. 1-10 E-3 31
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE
Develop capability to determine chemical composition of small solid particles dispersed in Space and in Comets, especially under conditions of high encounter velocities with sensors.

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [3] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1986]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 200K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Develop technology to perform chemical analyses of major elements and some minor elements in small (micron to millimeter sized) dust and ice particles as are expected in coma and tails of comets. High relative encounter velocities and short sensing times are expected (Laser Zapper).
2. Further develop technology to determine chemical composition of small dust and ice particles which vaporize in passing through upper atmosphere of Earth (micrometeorids).

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 2 OF 2

TITLE Spaceborne Meteorological Radar (Active Microwave Profiler)

NO. 11 E-3 30
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Perform analysis to determine optimum multi-frequency meteorological radar. Select an intermediate single frequency for development and flight on spacelab. Refly if necessary to improve fixed multiple beam radar approach. Develop second radar; fly and demonstrate in dual frequency mode. Develop free flyer configurations.

7. ALTERNATIVE APPROACHES/OPTIONS A subscale model can be developed for demonstration and testing of concept on RB-57F or equivalent aircraft.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Concept and preliminary feasibility studied under SRT 645-10-02

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Analysis	—	—																		
Develop radar #1			—	—	—															
Fly on spacelab						—														
Develop radar #2 (Spacelab)							—	—												
Fly dual freq.									—											
Develop free flyer config										—	—	—								
Fly free flyer													—							
SRT, ANT, RCVE, R Program, sig. proc., xmitters, pointing subsystems		—	—	—	—	—	—	—	—	—										
MANPOWER (M-Y) INHOUSE	3	3	5	5	5	7	7	5	7	5	5	5	8							
MANPOWER (M-Y) CONTRACT																				
FUNDING (10^6 $) INHOUSE	.1																			
FUNDING (10^6 $) CONTRACT	.1	.3	.45	5	10	2			2	5	5	5	2							

SPACE TECHNOLOGY NEED **FORM NO. 1**

PAGE 1 OF 2

1. TITLE Radial Velocity Spectrometer NO. 01.09/F3 32
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE
Radial velocity determination of distant stars to 6th magnitude to a precision of 2 meters/second

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1981]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE FY78 $300K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
Survey of candidate star spectra to select ultra sharp and stable spectral lines. Low light level detectors tuned to preselected wavelengths. Systems study to select most promising technique.

LEVEL OF STATE OF ART
1 BASIC PHENOMENA OBSERVED AND REPORTED
2 THEORY FORMULATED TO DESCRIBE PHENOMENA
3 THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4 PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5 COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6 MODEL TESTED IN AIRCRAFT ENVIRONMENT
7 MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED **FORM NO. I**

PAGE 2 OF 2

TITLE Compositional Analysis of Small Solid Particles NO. 10 E-3 31
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Develop instrument package such as mass spectrometer, emission spectrograph, etc., which is capable of chemical analyses of solid particles with velocities up to 10 Km/sec.
2. Increase sensitivity and element resolution of techniques and sensors used to determine composition of small grains which are vaporized in passage through upper atmosphere.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Some past support of (2) above, but program is not now active.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
1. Instrumentation for comet analysis.		—	—	—	—	—	—													
2. Micrometeorids		—	—	—	—	—	—													
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Low Cost Electronic Subsystem Technology

NO. 01,10,11,12,7,8,9/E3 33
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE Reduce the cost of digital electronic subsystems by 10 to 1.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1983]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [X] Development (Check one or more)

f) RBT BASE CANDIDATE 506-18-31 500K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY None

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Development of automated techniques for the design and fabrication of hybrids and large scale integrated circuits. Provide technology for higher yield, higher degree of integration and advanced hybrid packaging.

LEVEL OF STATE OF THE ART

1. BASIC PRINCIPLES OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE FUNCTION OF SYSTEM
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR ANALYTICAL MODEL
4. PRIMARY FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. II
PAGE 2 OF 2

TITLE Radial Velocity Spectrometer

NO. [illegible] 32
THEME / W.G. / TASK

DATE 6/20/76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Investigate candidate techniques. Develop tuned low light level detectors. Select correct stellar spectral lines. Build pilot system with 10 meter per second accuracy.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (NASA, OTHER)

Limited activities within astronomical community.

9. TECHNOLOGY SCHEDULE

SCHEDULE ITEM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM: Investigate possible techniques			▲	▲																
Select suitable lines			▲	▲																
Design pilot system				▲	—	▲														
Design & build complete system						▲	—	—	▲											
10. APPROPRIATE R&T $: IN-HOUSE																				
CONTRACT																				
11. MANPOWER (MY): IN-HOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. II

PAGE 2 OF 2

TITLE LOW COST ELECTRONIC SUBSYSTEM TECHNOLOGY

WBS 1.7.8.9.10.11.12/13.33

THEME / WBS / TASK

DATE 4 / 30 / 75

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

(1) Develop automated techniques for the design and fabrication of hybrids and large scale integrated circuits.

(2) Provide technology for higher yield, higher degree of integration and advanced hybrid packaging.

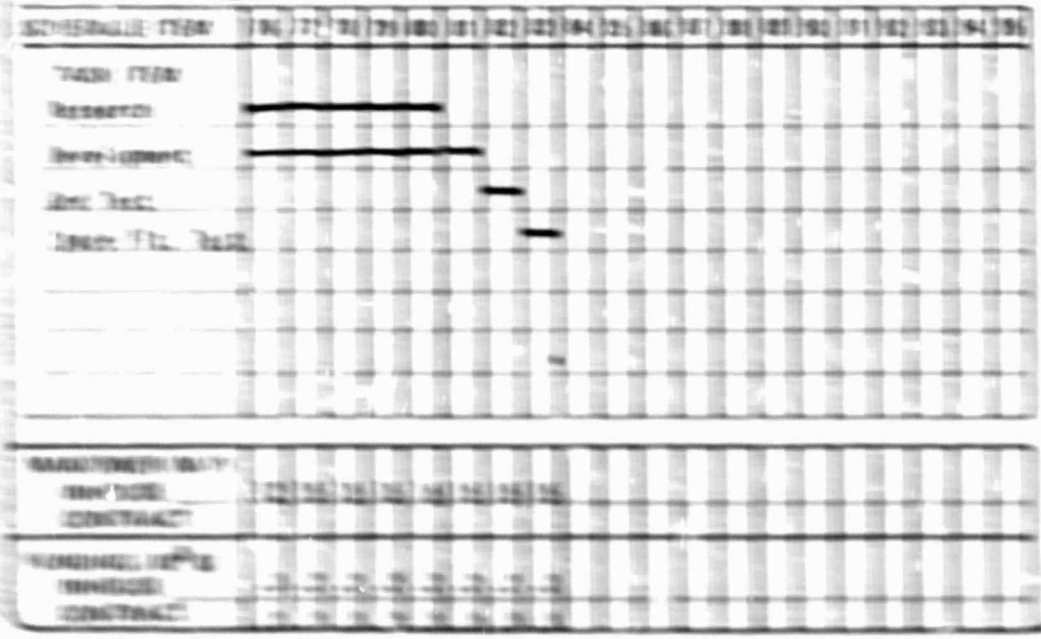
(3) Demonstrate the above.

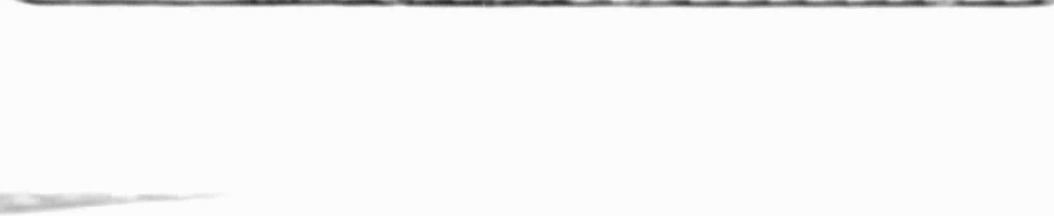
7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (OTEP, OTHER)

This work is presently done under 506-26-31, "Design, Processing and Testing of LSI Arrays. Provide custom low cost electronics as subsystems part of small vehicles.

9. TECHNOLOGY SCHEDULES





SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Column Density Monitor/Advanced Technology Radiometer

NO. 10/5-3 35
THEME/ WG / TASK

DATE 4 / 5 / 76

2. OBJECTIVES
(1) Measure contamination associated with present orbiter, (2) optimize orbiter operations for maximum astronomical yield, (3) demonstrate for advanced IR astronomy technologies.

3. [illegible]

a) [illegible] [X] [illegible] [X] [illegible]

b) [illegible] SHOULD BE TECHNOLOGY READY AT LEVEL [ ] FOR OPERATIONAL SYSTEMS BY (DATE) 1978

c) RISK IN ACHIEVING ADVANCEMENT
HIGH [ ] MEDIUM [ ] LOW [X]

d) [illegible]
[illegible] HIGH [X] MEDIUM [ ] LOW [ ]

e) [illegible] STUDY [ ] ANALYSIS [ ] RESEARCH [X]
GRD TEST [ ] [illegible] [ ] [illegible] FLIGHT TEST [X]
OTHER (Specify) [ ] [illegible]

f) [illegible]

4. [illegible]
[illegible] Onboard mass spectrometers, low contamination orbiter Reusable Surface Insulation and Adhesives.

5. [illegible]

- Cryogenic cooling techniques below [illegible]
- Far IR detector sensitivity improvement
- Detector array fabrication techniques
- Far IR filter improvement
- Spatial (?) chopping techniques

SPACE TECHNOLOGY NEED | **FORM NO. I**

TITLE Low Cost Hybrid Technology

NO. 07,08,09,10,11,12 / 01/E3 34

THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Determine automated techniques for flip chip conductive epoxy bonding. Define hardware specification. Contract for the design and fabrication of automated bonding system. Test, document and demonstrate cost savings available. This technique will take advantage of the transparency of SOS LSIC's.

7. ALTERNATIVE APPROACHES/OPTIONS Beam lead system - difficult to handle, shifts cost and yield burden to LSIC manufacturer.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Reliable hybrid fabrication guidelines have been developed under 506-18-31. FY78-80 work under that RTOP would shift emphasis to supporting and extending low cost techniques.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Study																				
Analysis																				
Design & Dev.																				
MANPOWER (MY)																				
IN-HOUSE			[illegible]	[illegible]	[illegible]															
CONTRACT																				
FUNDING ($M)																				
IN-HOUSE			[illegible]	[illegible]																
CONTRACT					[illegible]															

SPACE TECHNOLOGY NEED

FORM NO. 1
PAGE 2 OF 2

TITLE Radial Velocity Spectrometer

NO. 1,09/E-3 32
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Investigate candidate techniques. Develop tuned low light level detectors. Select correct stellar spectral lines. Build pilot system with 10 meter per second accuracy.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Limited activities within astronomical community

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Investigate possible techniques			Δ	Δ																
Select suitable lines			Δ	Δ																
Design pilot system				Δ	—	Δ														
Design & build complete system						Δ	—	—	Δ											
MANPOWER (M-Y) INHOUSE					1	3	3	3	3											
CONTRACT			2	2	4	6	10	6	2											
FUNDING (10^6 $) INHOUSE																				
CONTRACT			.1	.1	.2	.5	1.0	1.0	.5											

SPACE TECHNOLOGY NEED

FORM NO. 1

1. TITLE Low Cost Hybrid Technology

NO. 01/07,08,09,10,11,12 34
THEME / W.G. / TASK

DATE 4 /27/76

2. OBJECTIVE

The Development and Demonstration of Techniques to Reduce Hybrid Fabrication Costs by 3/1.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [x]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [x] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [x] ANALYSIS [x] RESEARCH [ ]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [x] Design and Development (Check one or more)

f) BAT BASE CANDIDATE 100K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY NONE

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Automatic Flip Chip Bonding of L SIC'S with Conductive Epoxy.

LEVEL OF STATE OF ART

1. BASIC PRINCIPLES OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. COMPONENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I** — PAGE 2 OF 2

TITLE LOW COST ELECTRONIC SUBSYSTEM TECHNOLOGY

NO. 1,7,8,9,10,11,12/E333
THEME / W.G. / TASK

DATE 4 /27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

(1) Develop automated techniques for the design and fabrication of hybrids and large scale integrated circuits

(2) Provide technology for higher yield, higher degree of integration and advanced hybrid packaging

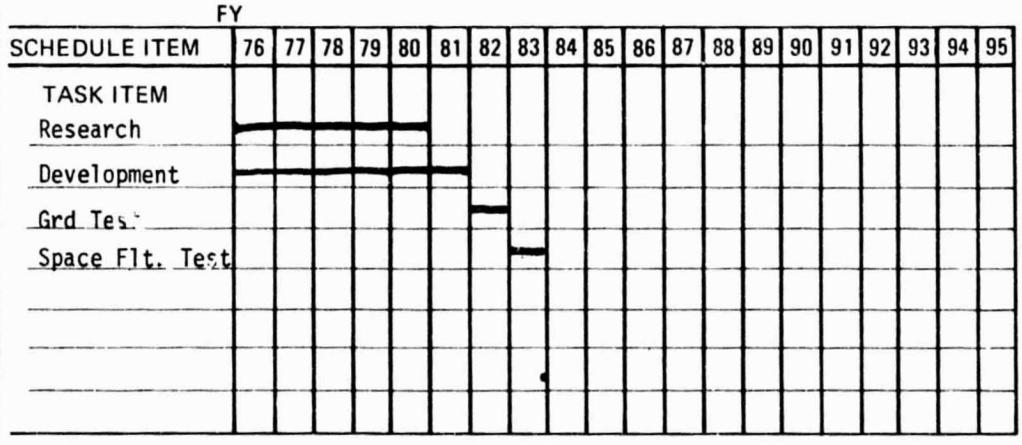
(3) Demonstrate the above.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

This work is presently done under 506-18-31, "Design, Processing and Testing of LSI Arrays. Provides custom low cost electronics to implement part of smart sensors.

9. TECHNOLOGY SCHEDULES



	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
MANPOWER (M-Y) INHOUSE	12	15	15	15	15	15	15	15												
CONTRACT																				
FUNDING (10^6 $) INHOUSE	.3	.2	.2	.2	.2	.2	.2	.2												
CONTRACT	.2	.3	.3	.3	.3	.3	.3	.3												

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Column Density Monitor/Advanced Technology Radiometer

NO. 12/E-3 35
THEME / W.G. / TASK

DATE 4 /26/ 76

2. OBJECTIVE

(1) Measure contamination associated with present orbiter, (2) optimize orbiter operations for maximum astronomical yield, (3) demonstrate for advanced IR astronomy technologies.

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1979]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Onboard mass spectrometers, low contamination orbiter Reusable Surface Insulation and Adhesives.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

- Cryogenic cooling techniques below 10 Kelvin
- Far IR detector sensitivity improvement
- Detector array fabrication techniques
- Far IR filter improvement
- Special spatial chopping techniques

SPACE TECHNOLOGY NEED

FORM NO. I

PAGE 2 OF 2

TITLE Low Cost Hybrid Technology

NO. 07,08,09,10,11,12 01/E3 34

THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Determine automated techniques for flip chip conductive epoxy bonding. Define hardware specification. Contract for the design and fabrication of automated bonding system. Test, document and demonstrate cost savings available. This technique will take advantage of the transparancy of SOS LSIC's.

7. ALTERNATIVE APPROACHES/OPTIONS Beam lead system - difficult to handle, shifts cost and yield burden to LSIC manufacturer.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Reliable hybrid fabrication guidelines have been developed under 506-18-31. FY78-80 work under that RTOP would shift emphasis to supporting and extending low cost techniques.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Study			—	—																
Analysis				—	—															
Design & Dev.					—	—	—													
MANPOWER (M-Y) INHOUSE			2	2	2	2														
CONTRACT																				
FUNDING (10^6 $) INHOUSE			.1	.1																
CONTRACT					.1	.1														

SPACE TECHNOLOGY NEED

FORM NO. 1

1. TITLE Planetary Quarantine Facility in Near-Earth Environment.

NO. 10 / E-3 36
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE

Develop facility for carrying out preliminary examination of returned remote samples under quarantine constraints.

3. NEED ANALYSIS

a) LEVEL NOW [2], WILL BE LEVEL [2] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5/] FOR OPERATIONAL SYSTEM USE BY [DATE: 1990]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [X] MEDIUM [ ] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) BEST BASE CANDIDATE 75K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Biological sterilization procedures,
Space laboratory operations.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

A. Document criteria by which samples are determined to be non-harmful to earth environment and quarantine may be lifted.

B. Technique of sterilization of limited portion of returned samples.

C. Possibility of isolated facility to carry out scientific studies of quarantined samples.

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 2 OF 2

TITLE Column Density Monitor Advanced Technology Radiometer

NO. 12/E-3 35
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Build and operate an advanced IR Telescope from the orbiter payload bay. Use opportunity to flight test advanced IR instrumentation and cryogenic technology

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Submitted as FY78 New Initiative #109

9. TECHNOLOGY SCHEDULES

	FY																			
SCHEDULE ITEM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
MANPOWER (M-Y)																				
INHOUSE		4	4	5	5	3														
CONTRACT				1	1	1														
FUNDING (10^6 $)																				
INHOUSE		.45	.45	.25	.16	.04														
CONTRACT			.4	.6	.4	.01														

SPACE TECHNOLOGY NEED — **FORM NO. I**

1. TITLE MULTICHANNEL INFRARED RADIOMETER (GEOSYNCHRONOUS IR SOUNDER)

NO. 11 E-3 37 (THEME / W.G. / TASK)

DATE 4 / 28 / 76

2. OBJECTIVE

To provide temperature and water vapor distribution in the atmosphere from geosynchronous meteorological spacecraft, and to measure wind fields and cloud motion.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1983]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [ ] GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Development of diffraction limited telescopes, nitrogen coolded radiative cooler technology

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

This sensor development was initiated AASIR under AAFE. Development is being continued under the STORMSAT program. Sensor is a candidate FY-78 new start. This radiometer,will allow temperature profiles and water vapor profile to be determined with a resolution of 13km, with variable frame size from full earth to 500 km x 500 km, and with frame rates as fast as 1 minute. Sensor also incorporates an ultra-high resolution visible mapping channel for cloud motion detection.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I** — PAGE 2 OF 2

TITLE Planetary Quarantine Facility in Near-Earth Environment

NO. 10 E3 36 (THEME / W.G. / TASK)

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Develop methods for sample containment, quarantine and analysis prior to return to earth. Develop criteria by which samples can be determined to be safe. Develop technique for sterilization a portion of sample. Facility development for preliminary scientific study of returned remote sample.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

OSS has only preliminarily examined this facility.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Sterilization			●	—	—	—	—	●												
Isolation facility			●	—	—	—	—	—	—	—	●									
Non-harmful criteria			●	—	—	—	—	—	—	—	●									
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 1 OF 2

1. TITLE ADVANCED INTERFEROMETER SPECTROMETER NO. 10/E-3/ 38
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE
Adapt high performance HSI's to planetary atmospheric sensing, and atmospheric pollution studies

3. NEED ANALYSIS

a) LEVEL NOW [6], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE:]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [x] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Stratospheric HSI development for shuttle.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Optical design needs to be designed for wider temperature range.
2. Develop cryogenic sensor cooling for long-life operation.
3. Develop low noise IR defectors.
4. Develop data analysis and compression techniques.
5. Cooling system for entire instrument.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

TITLE MULTICHANNEL INFRARED RADIOMETER (GEOSYNCHRONOUS IR SOUNDER)

NO. 11/E-3 37
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Use results of Hughes Aircraft design study (AAFE supported) for development of AASIR.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

AASIR-AAFE development

9. TECHNOLOGY SCHEDULES

FY / SCHEDULE ITEM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Analysis		—																		
Development		—	—	—	—															
Ground Test						—														
Space Flight Test								—	—											
MANPOWER (M-Y) INHOUSE		2	2	2	2	2	2	2	2	2										
CONTRACT		5	25	25	25	5	2	2	2	2										
FUNDING (10^6 $) INHOUSE		.1	.2	.2	.2	.2	.2	.2	.2	.2										
CONTRACT		.4	4	4	4	.4	.2	.2	.2	.2										

SPACE TECHNOLOGY NEED — **FORM NO. 1**

1. TITLE Advanced Technology Thematic Mapper — **NO.** 11/E-3/39 (THEME / W.G. / TASK)

DATE 4 /28/76

2. OBJECTIVE

To obtain high resolution imagery in seven or more spectral bands spanning the visible through the thermal infrared for a wide variety of earth resources applications experiments.

3. NEED ANALYSIS

a) LEVEL NOW [2], WILL BE LEVEL [3] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1985]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X] GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Detector technology, cooling technology, diffraction limited optics technology, scanning system technology, data compression and data management.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Obtain 10 m spatial resolution or better in 7 spectral bands from 1000 km orbits with high geometric accuracy for good image quality and precise intra-spectral band registration. High signal to noise (100/1) required for earth targets of typical interest. Data compression and management system required to handle very data rates.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

TITLE Advanced Interferometer Spectrometer NO. 10 / E-3 / 38
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Wide temperature range optics
2. Cryogenic sensor cooling
3. Develop low noise IR detectors
4. Develop data compression methods
5. Instrument cooling system

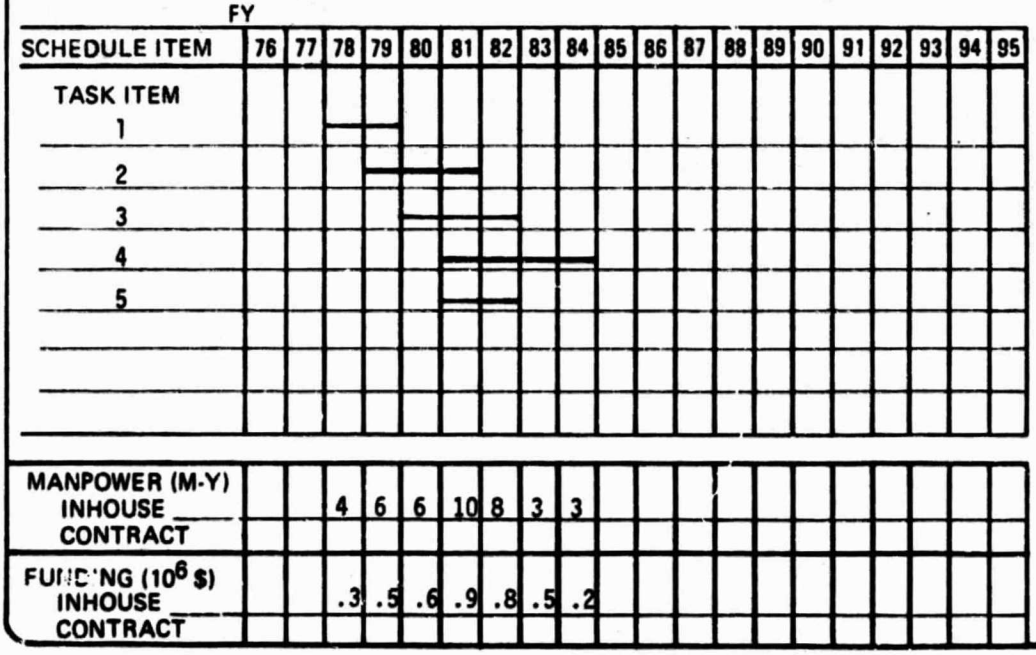
7. ALTERNATIVE APPROACHES/OPTIONS

None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES



SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Planetary Reconnaissance from Near Earth

NO. 10/E-3/40
THEME / W.G. / TASK

DATE 4 / 27 / 76

2. OBJECTIVE Develop Multispectral Imaging Sensors from UV to 20μ for ST retrofit, and test on smaller earth orbiting telescopes.

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT -- SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1986]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [x] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [x] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [x] RESEARCH [x] GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [x] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Area Array Imagers to 3μ and line arrays from 3 to 20μ.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

An all reflecting multispectral imaging spectrometer is required to allow moderate spectral (100Å) and high spatial resolution (500 elements full disc on Jupiter) to study time varying planetary phenomena and as early reconnaissance for some outer planet bodies. The device would be LST compatible and could be flown on early shuttles with smaller telescopes.

LEVEL OF STATE OF THE ART

1. BASIC PRINCIPLES OBSERVED
2. THEORY FORMULATED
3. THEORY TESTED BY ANALYSIS OR EXPERIMENT
4. COMPONENT OR BREADBOARD VALIDATED IN LABORATORY ENVIRONMENT
5. COMPONENT OR BREADBOARD VALIDATED IN RELEVANT ENVIRONMENT
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT
8. SYSTEM INCORPORATED IN DESIGN
9. SYSTEM "FLIGHT PROVEN" THROUGH SUCCESSFUL MISSION OPERATIONS

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 2 OF 2

TITLE Thematic Mapper NO. 11/E-3/39

THEME / W.G. / TASK

DATE 4 / 29 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Pushbroom linear array technology box scanning mechanism.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Thematic mapper development precursor to proposed development.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Study			—																	
Analysis				—																
Development					—	—	—													
Test								—												
MANPOWER (M-Y) INHOUSE			2	2	2	2	2	2	2											
CONTRACT			5	5	5	5	5	5	5											
FUNDING (10^6 $) INHOUSE			0.1	0.1	.1	.1	.1	.1	.1											
CONTRACT			0.4	.4	.4	.4	.4	.4	.4											

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 1

1. TITLE LSI Sensor Electronics - NASA Network for Custom LSIC Computer Aided Design

NO. 01/E3 07,08,09,10,11,12 40A

THEME / W.G. / TASK

DATE 4 / 27 / 76

2. OBJECTIVE

Provide 5 NASA Centers with Autonomous Data Linked State of Art LSI Design Systems for 4/1 Reduction of Design Time, 3/1 Reduction of Design Costs, Shared Software.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1980]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [x]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [x] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [ ]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [x] System Integration (Check one or more)

f) R&T BASE CANDIDATE 200K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY NONE

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

The implementation of existing software on State of Art Midi Computer plus the development of some user oriented extensions. This system will enhance NASA's use of custom designed LSIC's.

LEVEL OF STATE OF ART
1. BASIC PRINCIPLES OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 2 OF 3

TITLE Planetary Reconnaissance From Near Earth

NO. 10 / E-3 / 40
THEME / W.G. / TASK

DATE 4 / 28/ 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Perform system tradeoffs
2. Focal Plane Instrument Design
3. Fab Sensor
4. Shuttle Tests
5. Space Telescope Retrofit Design
6. Flight Program

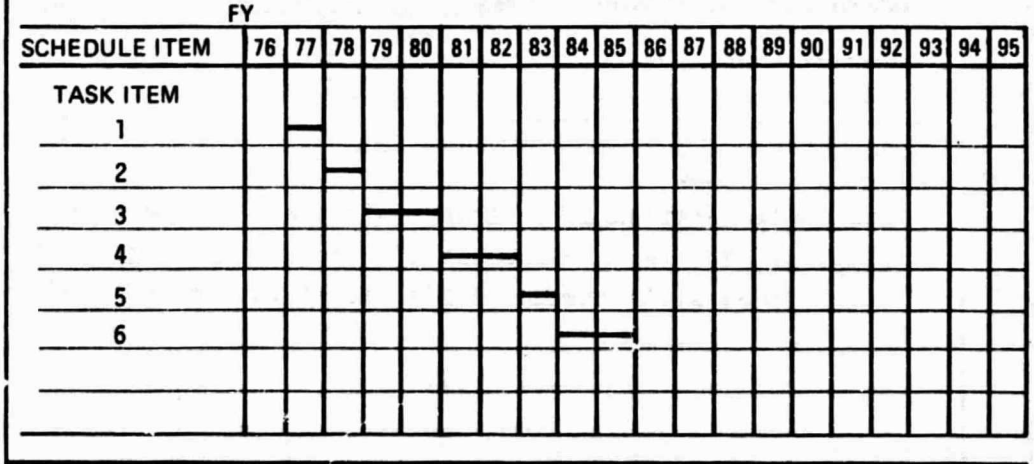
7. ALTERNATIVE APPROACHES/OPTIONS

None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES



	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
MANPOWER (M-Y)																				
INHOUSE		1	2	3	3	2	3	3	4	3										
CONTRACT			1	1	2	2	3	3	3	2										
FUNDING (10^6 $)																				
INHOUSE		.1	.1	.2	.3	.5	.5	.3	.2	.1										
CONTRACT		.1	.2	.2	.4	.5	.5	.5	.1	.1										

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 1 OF 2

1. TITLE Mass Spectrometric Methods of Surface Compositional Analyses

NO. 1-10 E-3 42
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE

Develop improved mass spectrometric methods of analysis which are applicable for planetary surface materials.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1987]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [x] ANALYSIS [x] RESEARCH [x] GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [x] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 100K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Instrument and Sensor development

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Develop improved high sensitivity, high resolution mass spectrometer for 1-200 amu mass range.
2. Develop required ionization sources for analyses of solid materials.
3. Develop element fractionation and analysis techniques for analysis of volatile elements and compounds (e.g. G.C. and thermal analyzer interfacing to M.S.)
4. Develop improved methods of data reduction and compression.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTIMENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

TITLE LSI Sensor Electronics - NASA Network for Custom LSIC Computer Aided Design

NO. 07,08,09,10,11,12, 40A 01/F-3 THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Order 50K of add on hardware to control computer purchased for the Facility for Electronic Development (FED) under 506-18-31 in FY78. Order 2/yr. complete 150K hardware systems in FY79 and FY80 for Network centers. Contract for software man/machine extensions and transfer of present Computer Aided Design and Test (CADAT) system software in FY78.

7. ALTERNATIVE APPROACHES/OPTIONS Fund network hardware systems elsewhere at savings of 150K per system.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Basic CADAT system software and 100K of multipurpose hardware is being provided under 506-18-31.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Sys. Integration			—	—	—															
MANPOWER (M-Y) INHOUSE			3.5	2.5	1															
CONTRACT																				
FUNDING (10^6 $) INHOUSE			.05	.3	.3															
CONTRACT			.15																	

SPACE TECHNOLOGY NEED — **FORM NO. I**

PAGE 1 OF 1

1. TITLE Microwave (or longer wave) Subsurface Sounding (Earth or Planets) and Ice Thickness Sensor

NO. 10 & 11/3-E/ 43 (THEME / W.G. / TASK)

DATE 4 / 27 / 76

2. OBJECTIVE
To determine details of subsurface structure with a minimum of drilling of cores.

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 9/87]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Processing of returns to provide profile of subsurface materials for extrapolation of contact measurements.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
Determination of optimum wavelengths for best penetration of various distributions of dielectric constant materials should be initiated.
Equipment for optimum pulse length at best power should be investigated.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

TITLE Mass Spectrometric Methods of Surface Compositional Analyses

NO. 10 E-3 42
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Methods development of flight qualified instruments for analysis of solid and gaseous samples using mass spectrometric method of analysis. Development of ionization methods and sample introductions into Mass Spectrometer.

7. ALTERNATIVE APPROACHES/OPTIONS

None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Some instrument support presently from OSS - i.e. Viking OSS analysis program of extraterrestrial materials study.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Mass Spectrometer		├	─	─	─	─	─	─												
Ionization Sources		├	─	─	─	─	─	─												
Fractionation techniques		├	─	─	─	─	─	─	┤											
Data Reduction		├	─	─	─	─	─	─	┤											
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Ancillary Information for Remote Sample Return

NO. 1- 10 E-3 44
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE

Determine specified characteristics of samples and sample's environment prior to and during collection.

3. NEED ANALYSIS

a) LEVEL NOW [2], WILL BE LEVEL [2] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT -- SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982 - 1984]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 150K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

A. Imaging (i.e., topography, craters, rocks and soil type)

B. Local meteorological conditions (i.e., temp., press., wind velocity, etc.)

C. Basic physical and chemical characteristics of local material, i.e., major element analysis (-XRF, α-particle etc.) soil cohesiveness

LEVEL OF STATE OF THE ART

1. BASIC PRINCIPLES OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. ; PAGE 2 OF 2

TITLE Microwave (or longer wave) Subsurface Sounding (Earth or Planets) and Ice Thickness Sensor

NO. 10 & 11/3-E/ 43 (THEME / W.G. / TASK)

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

A variable frequency device of sufficient power will be built and deployed for ground test. Pulse returns will be studied and compared with actual cored samples for correlation. Coupled vs remote systems will be evaluated and interference of surface mismatch determined.

7. ALTERNATIVE APPROACHES/OPTIONS Magnetic field deployment and study of interaction for deduction of distribution of subsurface material.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Surface moisture studies at JSC. Lake ice thickness measurements at Lewis.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Build Xmitter Receiver		—																		
Deploy in field		—	—																	
Correlate with ground measurements			—	—																
Select best wave length & pulse and build operational device					—															
MANPOWER (M-Y) INHOUSE		2	2	2	2															
CONTRACT																				
FUNDING (10^6 $) INHOUSE		.2	.2	.2	.2															
CONTRACT		.2	.2	.2	.2															

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 1 OF 2

1. TITLE Narrow Field of View Limb Scanning Filter Radiometers NO. 11/E-3 45 THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE

Global monitoring of vertical profiles of gaseous & particulate stratospheric constituents & parameters using either IR emission of, or absorption by, earth's limb.

3. NEED ANALYSIS Req'd. capabil/present capabil

a) LEVEL NOW 4/4 [ ], WILL BE LEVEL 4/7 [ ] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1981]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR X ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X] GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ] OTHER (Specify) [X] Basic constituent absorption data (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Improved detector coolers, improved IR calibration technologies and equipment; improved signal processing electronics; improved on-board data processing equipment.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

- Additional analysis & design of sensor components and mechanisms for long duration missions or reuse on shuttle
- Analysis and design of additional spectral channels for solar occulation to measure optical model parameters (0.3 to 2.0 μm)
- Develop and test engineering models of sensors to provide "shuttle-ready" sensor hardware
- Develop improved data management technologies for on-board partial, or complete, data reduction/"Smart Sensor"

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

TITLE Ancillary Information for Remote Sample Return

NO. 10 E3 44
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

SR&T support of instrument development for planetary surface analyses (X-ray, fluorescence, alpha-particle spectrometer, gamma-ray spectrometer, grain size measurements, imaging, seismic instruments, heat flow, etc.)

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Viking instruments - OSS

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Imaging			⊢	—	—	—	⊣													
Meteorological			⊢	—	—	—	⊣													
Chemical Element Analysis			⊢	—	—	—	—	—	⊣											
Soil Physical Properties			⊢	—	—	—	⊣													
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

1. TITLE Interplanetary Cruise Observatory Telescope for High-Resolution Imagery Of Solar System Objects

NO. 10/E-3/3 46
THEME / W.G. / TASK

DATE 4. /27 / 76

2. OBJECTIVE Develop diffraction limited, structurally rugged, thermally compensated long focal length telescope to enable observatory work between planets.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [ ] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1980]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [ ]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE No

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Thermal Compensation Materials
2. Thermal Control
3. Structural Integrity of 1 in 10^5

(1), (2), (3) needed to maintain diffraction-limited performance.

LEVEL OF STATE OF ART

1. BASIC PRINCIPLES OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. 1** — PAGE 2 OF 2

TITLE Narrow Field of View Limb-Scanning Filter Radiometers

NO. 11/E-3/ 45 (THEME / W.G. / TASK)

DATE 4/ /28 /76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

o Develop 6.0 μm to 20 μm limb scanning IR radiometer (LSIR) based on AAFE LACATE to space-hardened EM level

o Develop 0.3 to 2.0 μm Extenction Radiometer (SER) based on SAGE technology to space-hardened EM level.

7. ALTERNATIVE APPROACHES/OPTIONS Develop multichannel LHR for full 2.0 to 2.50 μ regions for Solar Occulation Use, Cryogenic Limb Interferometer-Spectrometer

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

642- LIMS Sensor Nimbus G 176-10-31 Scanning Sensors

SAGE/AEM-B

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM	FY 76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
LSIR Analysis		—	—																	
LSIR Research		—	—	—																
LSIR Grnd Test				→																
LSIR Space Flight					—															
SER Analysis		—	—																	
SER Research			—	—																
SER Grnd Test				—																
SER SF Test					—															
MANPOWER (M-Y) INHOUSE		10	18	20	15															
MANPOWER (M-Y) CONTRACT		2	3	4	5															
FUNDING (10^6 $) INHOUSE		.2	.3	.3	.4															
FUNDING (10^6 $) CONTRACT		1.8	2.0	2.0	.3															

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 1 OF 2

1. TITLE Correlation Interferometer Spectrometry for Atmospheric Pollutants

NO. 11/E3 47
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE

Extension of remote measurement capabilities for tropospheric gaseous constituents

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [6] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1980]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR
X ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Thermal Control, Detector, and Cooler Technology, Optical Filter Coating Technology

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

- Improved Stability Interferometer for Shuttle Environment
- Improved Data Management Tech's and Electronics to Facilitate Data Reduction

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 2 OF 2

TITLE Interplanetary Cruise Observatory Telescope fo
for High Resolution of Planets

NO. 10 / E-3 / 46
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Design Definition
2. Component Design
3. Telescope Fab.

7. ALTERNATIVE APPROACHES/OPTIONS

None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
1		—																		
2			—																	
3				—																
MANPOWER (M-Y) INHOUSE		2	2	2																
CONTRACT		1	1	1																
FUNDING (10^6 $) INHOUSE		.1	.2	.2																
CONTRACT																				

C-2

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 1 OF 2

1. TITLE Life Detection Sensors NO. 10 E3 48
THEME / W.G. / TASK

DATE 4 / 27 / 76

2. OBJECTIVE Further develop methods for detecting life via remote analysis procedures.

3. NEED ANALYSIS

a) LEVEL NOW [5], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY DATE: 88-89

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [X] MEDIUM [ ] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [x] ANALYSIS [x] RESEARCH [x]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [x]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE Sensors 100K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY
Biological, sterilization, planetary quarantine

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Develop life detection experiments with following capabilities
   a. automated microscope - resolution comparable to oil immersion (1000 magnification) on earth.
   b. culture capability on a variety of media.
   c. immunological testing.
2. Upgrading GC-MS
3. Development of unified biology expt.
4. Detection and measurement of water.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 2 OF 2

TITLE Correlation Interferometer Spectrumetry for Atmospheric Pollutants

NO. 11 E-3 47
THEME / W.G. / TASK

DATE 4 /28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

a. Extensive laboratory test program to evaluate correlation interferometer developed under AAFE

b. Analysis and design effort to provide improved spectral stability and reduce effects of radiant background variations

c. Modifications and test of "AAFE" sensor hardware for flight test on aircraft and shuttle using improved cryogenic cooler

7. ALTERNATIVE APPROACHES/OPTIONS High speed interferometer, laser heterodyne spectrometer, differential correlation radiometer

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

63E - - - CIMATS Sensor Development

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
a.																				
b.																				
c.																				
MANPOWER (M-Y) INHOUSE		3	4	5	2															
CONTRACT		1	2	2	1															
FUNDING (10^6 $) INHOUSE		.2	.1	.1	.1															
CONTRACT			.6	.5	.1															

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 1 OF 2

1. TITLE Visible/Near Infrared Polarimter for Atmospheric-Scattered Solar Radiation

NO. 11 E-3 49
THEME / W.G. / TASK

DATE 4 / 26 / 1976

2. OBJECTIVE To measure tropospheric aerosol densities and physical characteristics

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [3] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT -- SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1983]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [x] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [x] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] _____ (Check one or more)

f) R&T BASE CANDIDATE _____

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

- Improved polarimeter for scattered solar energy in the 0.35 to 1.0 μm spectral energy
- Flight test of polarimeter with ground truth program to refine data reduction algorithm

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 2 OF 2

TITLE Life Detection Sensors NO. 10 E-3 48

THEME / W.G. / TASK

DATE 4 / 27 / 75

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

SR&T work required on life detecting sensors - Upgrading Viking-type expts.

Development of flight qualified instruments

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

OSS previously supported through Viking funding.

OSS funding through planetary biology at low present level.

9. TECHNOLOGY SCHEDULES

FY / SCHEDULE ITEM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Life Detection Expt.																				
1. Automated microscope			═	═	═	═	═	═	═											
2. Culture Materials			═	═	═	═	═	═	═											
3. Immunology expts.			═	═	═	═														
GC-MS			═	═	═	═														
Unified Biology expt.			═	═	═	═	═	═	═											
H_2O Detectors			═	═	═	═														
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE SCIENTIFIC ANALYSIS OF REMOTE SAMPLE RETURN

NO! - 10 E-3 50
THEME / W.G. / TASK

DATE 4 /26 / 76

2. OBJECTIVE
Scientific analysis in individual laboratories of remote sample return utilizing state-of-the-art analytical capabilities.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1988]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R/T BASE CANDIDATE R&T Only 500K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
SR & T support of basic geochemical and geophysical analytical capabilities.

LEVEL OF STATE OF ART

1. BASIC PRINCIPLES OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

TITLE Visible/NIR Polarimeter for Atmosphere Scattered Solar Radiation

NO. 11/E-3/ 49
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

- Develop "solid state" polarimeter based on AAFE&SRT Polarimeter to measure solar energy scattered by tropospheric aerosols.
- A/C Flight Test program with comprehensive "ground truth" program to verify data analysis algorithm.

7. ALTERNATIVE APPROACHES/OPTIONS INS ITU A/C and Balloon sampling

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Analysis	—	—																		
Research	—	—	—	—																
Ground Test				—	—															
A/C Flt Test					—	—														
SF Test						—	—													

MANPOWER (M-Y) INHOUSE		1	2	2	4	4	1													
CONTRACT		1	1	1	2	2	1													
FUNDING (10^6 $) INHOUSE		.1	.1	.1	.1	.1														
CONTRACT		.2	.4	.3	.6	.3														

SPACE TECHNOLOGY NEED — **FORM NO. 1**

PAGE 1 OF 2

1. TITLE Laser Profiles for Assessment of Small movements of earth surface — NO. 11/E-3/ 52 (THEME / W.G. / TASK)

DATE 4 / 27 / 76

2. OBJECTIVE
Develop technique for making measurements to within one centimeter employing laser instrumentation for aircraft or spacecraft platform to determine tectonic place movement, subsidence, earthquake bulge detection.

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY DATE: 1985

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] _____ (Check one or more)

f) R&T BASE CANDIDATE _____

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
Measurement techniques in the order of 10 to 20 cm are currently available. An order of magnitude improvement in accuracy is required to make temporal measurements from space for determination of earch movements with 1 to 2 cm. Positional location of the platform, as well as the resolution capability of the laser profiles must be considered. Increased laser power, maneuver pulse, improved collecting and data handling techniques will be required.

LEVEL OF STATE OF ART
1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

PAGE 2 OF 2

TITLE Scientific Analysis of Remote Sample Return

NO. 10 E3 50
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Continued support of laboratory studies of terrestrial and extra-terrestrial materials in order to maintain state-of-the-art analysis capabilities.

7. ALTERNATIVE APPROACHES/OPTIONS OSS is presently supporting on-going research of extraterrestrial materials - New methods of analysis require R&T.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
SR&T																				
Analysis Support of Extraterrestrial Materials																				
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

PAGE 1 OF 2

1. TITLE Hi Power Lidar — NO. 1 & 11 E-3 52 (THEME / W.G. / TASK)

DATE 4 /26/ 1976

2. OBJECTIVE

To develop a high power pulsed laser for one to two orders of magnitude improvement in the state of the art for the measurement of pollution profiles, temperature profiling, water vapor profiling, and pressure profiling.

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [2] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1981]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [X] MEDIUM [ ] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X] GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE New - 500K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Development of an ultra high power pulsed laser (> 100 joule/pulse), tuneable with high frequency stability for the spectral range from 3 to 15 μm.

Required for major state of the art advances in meteorology, and pollution.

SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 2 OF 2

TITLE Laser Profiles for Assessment of Small Movements of Earth Surface

NO. 11 E-3 51
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

- o Establish current state of art for platform location and laser resolution.
- o Establish specific areas requiring improved performance.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

LAGOS

CLEGOS

9. TECHNOLOGY SCHEDULES

FY / SCHEDULE ITEM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Rqmts Def & Tech Assess			▬																	
Laser Meas Tech Dev				▬	▬	▬														
MANPOWER (M-Y)																				
INHOUSE																				
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT			.5	2	2	2														

SPACE TECHNOLOGY NEED — **FORM NO. 1**

PAGE 1 OF 2

1. TITLE Surface Analysis by In-Situ Reflective and Emissive Spectroscopy

NO. 1-10 E3 53 (THEME / W.G. / TASK)

DATE 4 / 27 / 76

2. OBJECTIVE Analyse surface mineralogy and geology at high spatial resolution.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X] GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 150K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Improved Infrared Imaging Systems and Cameras for surface operation on planetary bodies.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

- Reflective region (0.4 - 1.0 Micron) can be covered by existing imaging systems with special modifications which require technology advancements as follows:

  Zoom lens for high magnification coupled with high spectral resolution (100A.) Filtering at 10-20 spectral bands.

- Thermal Emissive Region (3-20 Microns) Cannot be covered by existing imaging systems. Need multispectral imaging with zoom lens system for high magnification. Linear CCD arrays operating in 3-20 Micron range are needed to construct imaging system.

LEVEL OF STATE OF ART

1 BASIC PHENOMENA OBSERVED AND REPORTED
2 THEORY FORMULATED TO DESCRIBE PHENOMENA
3 THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4 PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5 COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6 MODEL TESTED IN AIRCRAFT ENVIRONMENT
7 MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. 1**

PAGE 2 OF 2

TITLE HI-POWER LIDAR

NO. 1 + 11/E-3 52
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Investigate and modify, to our requirements, very high power Department of Defense developed, lidar systems.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Study			—																	
Analysis			—	—																
Research				—	—	—														
Development					—	—	—													
Ground Test							—	—												
MANPOWER (M-Y) INHOUSE			2	2	2	2	2	2												
CONTRACT			6	6	6	6	6	6												
FUNDING (10^6 $) INHOUSE			0.1	0.1	0.1	0.1	0.1	0.1												
CONTRACT			0.4	0.4	.4	.4	.4	.4												

SPACE TECHNOLOGY NEED

FORM NO. I

PAGE 1 OF 2

1. TITLE Detector Coolers for Remote Sensors - Vuillemier and Combination Radiative/ Joule Thomson - NO. 11 /E-3/ 54 THEME / W.G. / TASK

DATE 4 /26/ 76

2. OBJECTIVE
To provide detector coolers for shuttle launched payloads which will reduce recurring costs for reflying remote sensors

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [3] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1980]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [XX] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE New - $200K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Cryogenic transfer under OG cond.'s

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

- Design and breadboarding of space hardened Vuillemier coolers for 60-110K detector temperatures based upon past DOD aircraft cooler designs
- Design and analysis of demand-type Joule-Thomson expansion coolers for 60-110K detector temperatures
- Design, analysis, and breadboarding of combined radiative/ Joule-Thomson cooler using stored hi-pressure cryogen supply.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

TITLE Surface Analysis by In-Situ Reflective and Emissive Spectroscopy

NO. 10 E3 53
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Develop thermal, mid-infrared multispectral imaging systems.
Develop high resolution spectral filters for facsimile camera sensors.
Develop zoom lens capability for imaging systems in reflective and in in thermal spectral regions.

7. ALTERNATIVE APPROACHES/OPTIONS

Previous OSS - Viking

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Thermal IR Multispectral Imager			═	═	═	═	═													
Multispectral Facsimile Camera				═	═	═	═	═	═											
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1
PAGE 2 OF 2

TITLE Optical Element Filter Coating Technology

NO. 10-11 E-3 56
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Design & Development of Improved Spectral Measurement Equipment.
2. Tests of Coated Materiels from Stock (various coating techniques).
3. Design of Improved Coating Facility and Materiels.
4. Development of Improved Facility.
5. Tests of Samples from Improved Techniques

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM 1		—																		
2			—																	
3				—																
4				—																
5					—															
MANPOWER (M-Y) INHOUSE		1	1	1	1															
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT		.1	.1	.3	.2															

SPACE TECHNOLOGY NEED — **FORM NO. I** — PAGE 2 OF 2

TITLE Detector Coolers for Remote Sensors - VM and Combin. Radiative/J-T

NO. 10-11 E-3 54 (THEME / W.G. / TASK)

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

VM-1 - Design Study of Modification of Existing A/C VM for Shuttle Use

VM-2 - Prototype VM Development and Test

VM-3 - Modify VM Design and Prototype

R/JT1 - Design Demand type JT

R/JT2 - Design Cooler System

R/JT3 - Prototype System Development and Test

7. ALTERNATIVE APPROACHES/OPTIONS Solid Cryogen Refrigerators

Large Cryogen Dewars

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
VM1																				
VM2																				
VM3																				
R/JT1																				
R/JT2																				
R/JT3																				
MANPOWER (M-Y) INHOUSE		2	2	2																
CONTRACT																				
FUNDING (10^6 $) INHOUSE		.1	.1	.1																
CONTRACT		.5	.8	.5																

SPACE TECHNOLOGY NEED FORM NO. I

TITLE ABSORPTION PUMPING CRYOGENIC REFRIGERATOR NO. 1,10,11/E3/ 544
THEME / W.G. / TASK

DATE 4 / 28/ 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Study capabilities of zeolite materials to perform as gas storage/ compression medium
2. Determine techniques for implementation of the refrigeration cycle
3. Develop breadboard refrigerator and conduct laboratory evaluation

7. ALTERNATIVE APPROACHES/OPTIONS

Study programs in progress for technique development.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
1. Study	—																			
2 and 3		—	—	—																
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT		.1	.1																	

SPACE TECHNOLOGY NEED

FORM NO. I

PAGE 1 OF 2

1. TITLE Optical Element Filter Coating Technology

NO. 11 /E-3/ 56
THEME / W.G. / TASK

DATE 4 /26 / 76

2. OBJECTIVE

To obtain interference filter and multi-layer anti-reflectance coatings which are spatially and spectrally uniform to 1% across optical elements of several cm's dimension

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [2] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE:]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [X] MEDIUM [ ] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR X ENHANCING: HIGH [ ] MEDIUM [XX] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE New $60K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Improved laboratory spectral measurement tech's and equipment

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Improved coating technology to obtain uniform coatings on curved optical elements of several cm dimensions

LEVEL OF STATE OF ART
1. BAS DEVELOPMENTS OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. 1

TITLE Gravitometer for Orbital Measurement of Small-Scale Gravity Anomalies.

NO. 10/11 E3 55
THEME / W.G. / TASK

DATE 4/27/76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Identify most promising approach by engineering feasibility study (two possible approaches: On-board instrument and Orbital tracking).

Develop needed technology for most promising approach.

7. ALTERNATIVE APPROACHES/OPTIONS Two listed above.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

FY / SCHEDULE ITEM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Study		=																		
Development			=	=	=	=														
MANPOWER (M·Y)																				
INHOUSE																				
CONTRACT		100	-	-	-	DEPENDS ON APPROACH.														
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED — **FORM NO. I**

PAGE 1 OF 2

1. TITLE: Remote Scanning Electron Microscope with Non-Dispersive Detection and Small Particle (≤ 1 to 5 micros) Manipulator

NO. 1-10 E-3 57 (THEME / W.G. / TASK)

DATE 4 / 27 / 76

2. **OBJECTIVE**

Develop methods for characterizing grain sizes and particular types on planetary surfaces via scanning electron microscope with non-dispersive detectors for compositional determination.

3. **NEED ANALYSIS**

a) LEVEL NOW [4], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1989]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [X] MEDIUM [ ] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X] GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE: 100K

4. **COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY**

Optical sensors -, sample study of remote surfaces

5. **SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED**

Flight qualified scanning electron microscope with non dispersive detectors for chemical analysis. Instrument should be capable of grain-size analysis, morphological characterization and chemical analysis of remotely collected samples. Required to characterize planetary surfaces. Resolution of 50 to 100 Angstroms required.

Particle manipulator for material ≤ 1 to 5 micron in size. Such material may be found on dusty planetary surfaces. Manipulation should include sieving, individual particle handling, and ancillory controls.

LEVEL OF STATE OF ART

1 BASIC PHENOMENA OBSERVED AND REPORTED
2 THEORY FORMULATED TO DESCRIBE PHENOMENA
3 THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4 PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5 COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6 MODEL TESTED IN AIRCRAFT ENVIRONMENT
7 MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

TITLE Optical Element Filter Coating Technology

NO. 10-11 E-3 56
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Design & Development of Improved Spectral Measurement Equipment.
2. Tests of Coated Materiels from Stock (various coating techniques).
3. Design of Improved Coating Facility and Materiels.
4. Development of Improved Facility.
5. Tests of Samples from Improved Techniques

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
1		—																		
2			—																	
3				—																
4				—																
5					—															
MANPOWER (M-Y)																				
INHOUSE		1	1	1	1															
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT		.1	.1	.3	.2															

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 1 OF 2

1. TITLE Absolute Solar Radiometry Calibration Facility

NO. 1 & 11 E-3 58
THEME / W.G. / TASK

DATE 4 / 26 / 1976

2. OBJECTIVE

To provide a facility for spectral and integrated absolute calibration of solar irradiance and earth radiation budget radiometer

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [3] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1981]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE (New - 100K - 4 yr)

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY None

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

0.1% absolute calibration is required for the calibration of solar constant and earth radiation budget experiments. Lack of a calibration facility will cause waste of large sums of money budgeted for these planned experiments.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. I
PAGE 2 OF 2

TITLE Remote Scanning Electron Microscope with Non-Dispersive Detectors.

NO. 10 E3 57
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

SR&T development of flight qualified instrument with suitable resolution and detector of sensitivity suitable for all elements with a.m.u. greater than Nd. Manipulator for particle $\leq$ 1 to 5 micron for study capability.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
SEM			———	———	———	———	———	———	———											
X-ray detectors			———	———	———	———	———													
sample manipulator			———	———	———	———	———													
MANPOWER (M-Y) INHOUSE																				
MANPOWER (M-Y) CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
FUNDING (10^6 $) CONTRACT																				

SPACE TECHNOLOGY NEED **FORM NO. I**

PAGE 1 OF 2

1. TITLE Compositional Analyses of Planetary Surfaces by Remote Sensing of High Energy Particles NO. 1-10 E-3 59 THEME / W.G. / TASK

DATE 4/27/76

2. OBJECTIVE
Feasibility and development studies of utilizing neutrons, electrons, and alpha particles produced on planetary surfaces to accomplish remote sensing of composition.

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [3] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY DATE: 1982

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [X] MEDIUM [ ] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [ ] MEDIUM [X] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE Sensor 50K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Sensors

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Feasibility and development study of using alpha spectrometry for specific composition studies.
2. Feasibility study of using backstreaming electrons for specific composition studies.
3. Feasibility study of using neutron energy spectra for determining abundances of hydrogen and other light elements.

LEVEL OF STATE OF ART

1 BASIC PHENOMENA OBSERVED AND REPORTED
2 THEORY FORMULATED TO DESCRIBE PHENOMENA
3 THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4 PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5 COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6 MODEL TESTED IN AIRCRAFT ENVIRONMENT
7 MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. 1** — PAGE 2 OF 2

TITLE ABSOLUTE SOLAR RADIOMETRY CALIBRATION FACILITY

NO. 1 + 11/E-3 58 (THEME / W.G. / TASK)

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Use conical absolute radiometer to establish a facility for the absolute calibration of spectral and integrated irradiance to 0.1% accuracy based on detector based vs source based absolute standards.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Analysis			—																	
Research			——																	
Develop				——																
Test & Verify					—															
MANPOWER (M-Y) INHOUSE		2	2	2	2															
CONTRACT																				
FUNDING (10^6 $) INHOUSE		0.1	0.1	0.1	0.1															
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Narrow Band Spectral Radiometry Using Etalon Filter Techniques

NO. 11 /E-3/ 60
THEME / W.G. / TASK

DATE 4 /26 / 76

2. OBJECTIVE
To obtain improved spectral discrimination required for measurements of atmospheric constituents by obtaining 0.1 cm^{-1} resolution and tunable ± 1.0 cm^{-1}

3. NEED ANALYSIS

a) LEVEL NOW [2], WILL BE LEVEL [2] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE:]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE New - $100K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Improved optical coating technology

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

The analysis, design, and breadboard testing of a tunable narrow-band spectral filter for radiometric sensors. This will allow tuning of spectral filter to account for doppler shift of atmospheric spectra caused by spacecraft motion.

LEVEL OF STATE OF ART
1. BASIC PRINCIPLES OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PARAMETERS
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. I
PAGE 2 OF 2

TITLE Compositional Analyses of Planetary Surfaces by Remote Sensing of High Energy Particles

NO. 10 E-3 59
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

SR&T program to improve - resolution and sensitivity of available detection. Development of flight-qualified hardware.

7. ALTERNATIVE APPROACHES/OPTIONS

Alpha spectrometry has already been used to determine abundances of Rn, Po, etc., in lunar atmosphere.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

OSS has minor funding

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Alpha spectrometry			———	———	———	———	———													
Electron spectrometry			———	———	———	———	———													
Neutron spectrometry			———	———	———	———	———													
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED **FORM NO. I**

PAGE 1 OF 2

1. TITLE In-Situ Meteorological Station for Planetary Atmospheres

NO. 1-10 E3 61
THEME / W.G. / TASK

DATE 4 / 27 / 76

2. OBJECTIVE
Measure Micrometeorology near Planetary Surface.

3. NEED ANALYSIS

a) LEVEL NOW [5], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY DATE: 1985

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 50K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY
Sensor development for in-situ atmospheric measurements in hostile environment.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED
Standard meteorological instruments are to be modified to operate on Venus and Mars surface (hostile environments). Wind velocity, temperature, pressure, rainfall, solar illumination, lightning, thunder, and rainfall are to be measured.
For Venus application, long-term operation at elevated temperatures and pressures is required.

LEVEL OF STATE OF ART
1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I**

PAGE 2 OF 2

TITLE Narrow Band Spectral Radiometry Using Etalon Filter Techniques

NO. 11 E-3 60 (THEME / W.G. / TASK)

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Analysis and Design of Etalon Filter and Radiometer.
2. Development of Prototype Single Channel Sensor.
3. Laboratory Testing of Prototype Sensor.

7. ALTERNATIVE APPROACHES/OPTIONS Differential Correlation Radiometer

Interferometer/Spectrometer

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM 1		—																		
2			—																	
3				—																
MANPOWER (M-Y) INHOUSE		2	2	2																
CONTRACT																				
FUNDING (10^6 $) INHOUSE		.1																		
CONTRACT		.1	.3	.2																

SPACE TECHNOLOGY NEED **FORM NO. I**

PAGE 1 OF 2

1. TITLE NON-CRYOGENIC IR DETECTORS NO. 1 & 10/E-3/62
THEME / W.G. / TASK

DATE 4 /28 /76

2. OBJECTIVE
Develop long-wavelength IR detectors operating above 150°K for use with thermo-electric cooling

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [5] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1990]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [ ] MEDIUM [X] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Materials research in photo-voltaic, photoconductive and pyroelectric devices.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED **FORM NO. I**

TITLE In-Situ Meteorological Station for Planetary Atmospheres

NO. 10 E3 61
THEME / W.G. / TASK

DATE 4 / 27 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Standard meteorological instruments are to be modified and repackaged to permit long-term operation on Mars and Venus surface. Test in laboratory environmental chambers.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Previous OSS Viking studies.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Design Study			═	═	═															
Prototype					═	═	═													
Flight Instrument						═	═	═	═											
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED **FORM NO. 1**

PAGE 1 OF 2

1. TITLE High Resolution Heat Flow Determination on Planetary Surfaces

NO. 1-10 E3 63
THEME / W.G. / TASK

DATE 4/27/76

2. OBJECTIVE
Develop technique and detectors to measure temperature profile as a function of subsurface depth to enable determination of local heat flow.

3. NEED ANALYSIS

a) LEVEL NOW [4], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1982]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR
ENHANCING: HIGH [ ] MEDIUM [X] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 50K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Penetrometer sensor.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Implant temperature sensors to known subsurface depths on planetary objects and monitor temperature profile over a long period of time.
2. Investigate possible methods of in-situ measurements of heat loss notes from short term introduction of heat sources.

LEVEL OF STATE OF ART
1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED — **FORM NO. I** — PAGE 2 OF 2

TITLE Non-Cryogenic IR Detector

NO. 1. 10. 11 / E-3 / 12
THEME / W.G. / TASK

DATE 4 / 28/ 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Conduct research to determine most promising materials for operation above 150^{0} K.
2. Fabricate and test representative detectors in laboratory.
3. Fabricate, test, and demonstrate detectors in operational sensors.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Study contract funded through F.Y. 1976 for preliminary materials review.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Materials Study		—																		
Fab.& Test Lab.	Det		—																	
Fab.& Test Opr.	Sen.			—																
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^{6} $) INHOUSE																				
CONTRACT		.1	.1	.1																

SPACE TECHNOLOGY NEED **FORM NO. I**

PAGE 1 OF 2

1. TITLE SENSOR SUPPORTING TECHNOLOGY NO. 10/E-3/[redacted] 64
THEME / W.G. / TASK

DATE 4 / 28 / 76

2. OBJECTIVE
Develop ancillary technology for sensor support

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1985]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [x]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [ ] MEDIUM [X] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [X]
GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Sensor cooling (e.g., closed loop, long life, low temperature cryostat).
2. Radiation effects studies.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. I
PAGE 2 OF 2

TITLE High Resolution Heat Flow Determination on Planetary Surfaces

NO. 10 E3 63
THEME / W.G. / TASK

DATE 4/27/76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Develop flight acceptable heat probe instrument suitable for panetrometer and 5 ft. lander on planetary surfaces. SR&T program of instrument development.

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

Previous OSS funding for ALSEP None currently - related to penetrometer program.

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Heat Flow		⊢	—	—	—	—	—	—	—	⊣										
Implant Sensors			⊢	—	⊣															
Calibration			⊢	—	—	—	—	⊣												
Study																				
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Tuneable Acousto-Optic Filter (TAOF) for Full Frame Imaging Spectrometry

NO. 10/E-3/65
THEME / W.G. / TASK

DATE 4 / 27 / 76

2. OBJECTIVE

Develop large aperature, wide spectral coverage TAOF's.

3. NEED ANALYSIS

a) LEVEL NOW [1], WILL BE LEVEL [7] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [6] FOR OPERATIONAL SYSTEM USE BY [DATE: 1985]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [X] OR ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [x] ANALYSIS [ ] RESEARCH [x]
GRD TEST [x] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) BOT BASE CANDIDATE

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

Expanded spectral coverage of CCD imagers and image processing methods.

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Develop a class of TAOF's which don't require narrow angle polarizing filters (feasibility has been established). By combining such TAOF's with CCD's and image processing, chemically specific imaging can be performed (e.g., SO_2, O_3 and NO_2 can all be uniquely separated from atmospheric imaging thus giving their spacial distributions).

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 2 OF 2

TITLE Sensor Supporting Technology NO. 10/E3/[redacted] 64
THEME / W.G. / TASK

DATE 4 / 28 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

1. Cooling Developments
2. Radiation Effects Studies

7. ALTERNATIVE APPROACHES/OPTIONS

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
1		▬	▬	▬	▬	▬	▬	▬	▬	▬										
2		▬	▬	▬	▬	▬	▬	▬	▬	▬										
MANPOWER (M-Y) INHOUSE	4	4	4	4	4	4	4	4	4											
CONTRACT																				
FUNDING (10^6 $) INHOUSE	.3	.3	.3	.3	.3	.3	.3	.3	.3											
CONTRACT																				

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 1 OF 2

1. TITLE Fiber Optics/Integrated Applications Program

NO. 1,10,11,12 E 3654
THEME / W.G. / TASK

DATE 04 / 28 / 76

2. OBJECTIVE
To apply fiber optics to data transmissions and processing systems both of a flight and ground nature.

3. NEED ANALYSIS

a) LEVEL NOW [2], WILL BE LEVEL [ ] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [5] FOR OPERATIONAL SYSTEM USE BY [DATE: 1985]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [X] RESEARCH [ ].
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [ ]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE RTOP 506-18-23 FY'78 NOA $250k

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY Laser sources being developed by LaRC

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

1. Increase data transfer speed goal: 10^9 bit/sec
2. Develop direct optical memory interfacing
3. Develop system capability for performance analysis, parameters trades and system demonstration

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED

FORM NO. I
PAGE 2 OF 2

TITLE Tunable Acousto-Optic Filter (TACF)

NO. 10 / E-3 / 65
THEME / W.G. / TASK

DATE 4 / 28/ 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Develop Wide Aperature

7. ALTERNATIVE APPROACHES/OPTIONS

None

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

None

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Development		—	—	—	—															
MANPOWER (M-Y)																				
INHOUSE		2	3	3	3															
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE		.2	.4	.4	.3															
CONTRACT																				

SPACE TECHNOLOGY NEED

FORM NO. 1

PAGE 1 OF 2

1. TITLE Photon Detectors for Wavelengths Longer Than 30 μm

NO. 01/E-3 66
THEME / W.G. / TASK

DATE 4 / 26 / 76

2. OBJECTIVE Improved photon detectors for IR astronomy

3. NEED ANALYSIS

a) LEVEL NOW 3', WILL BE LEVEL 5 UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1983]

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [ ] LOW [X]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [ ] ANALYSIS [ ] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [X] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE 506-18-xx, $165K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

(1) Increased sensitivity under low-background conditions

(2) Increased resolution and imaging capability through multi-element arrays.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 2 OF 2

TITLE Fiber Optics Applications Program NO. 1.10.11 E3 65A
THEME / W.G. / TASK

DATE 04 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

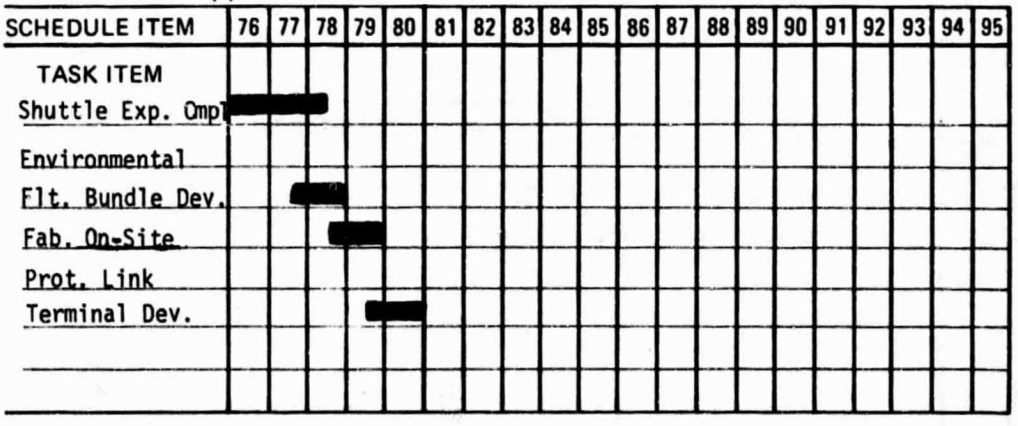
To establish a program of identifying specific demonstrations such as Space Shuttle and other ground uses that will allow the system techniques of using fiber optics to mature.

7. ALTERNATIVE APPROACHES/OPTIONS The alternative is to not integrate fiber optics technology into NASA ground and flight programs.

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

RTOP 506-18-23 Fiber Optics for Data Transmissions and Processing

9. TECHNOLOGY SCHEDULES



SPACE TECHNOLOGY NEED FORM NO. 1

PAGE 1 OF 2

1. TITLE Feed Design for Large Antennas NO. 09/E3/67
THEME / W.G. / TASK

DATE 4 / 30 / 74

2. OBJECTIVE Optimize Antenna Sensitivity

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [4] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY [DATE: 1990]

c) RISK IN ACHIEVING ADVANCEMENT: HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [ ] OR ENHANCING: HIGH [X] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X] GRD TEST [ ] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X] OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE FY 78 $200K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Achieve high sensitivity low side lobe antenna design.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED FORM NO. I

TITLE Photon Detectors for Wavelengths longer than 30 μm

NO. 01/E-3 66
THEME / W.G. / TASK

DATE 4 / 28 / 76

6. RECOMMENDED APPROACH/PROGRAM PLAN TO ACCOMPLISH NEED

Improved Bolometers operating at temperatures below 1 Kelvin may be improved from a NEP of $5X10^{-15} w/\sqrt{Hz}$ by improved fabrication techniques and composition. Josephson micro-bridges will be exploited for use as IR detectors. Array fabrication techniques will be explored.

7. ALTERNATIVE APPROACHES/OPTIONS Improved photoconductors may be developed

8. CURRENT/PLANNED RELATED ACTIVITIES (RTOP, OTHER)

RTOP has been submitted to Code RE 506-16-XX

9. TECHNOLOGY SCHEDULES

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK ITEM																				
Evaluate PbSnIe Arrays	●	●																		
Fabricate & Evaluate Silicon Bolometer Array	●	●																		
Investigate Josephson Microbridges	●	—	—	●																
MANPOWER (M-Y) INHOUSE	3	3	3	3																
CONTRACT	1	2	3	3																
FUNDING (10^6 $) INHOUSE																				
CONTRACT	.1	.1	.2	.2																

SPACE TECHNOLOGY NEED FORM NO. I

PAGE 1 OF 2

1. TITLE Large Aperture Antennas NO. 9/E3/68
THEME / W.G. / TASK

DATE 4 / 30 / 76

2. OBJECTIVE Determine optimum configuration for a very large aperture antenna on earth or in space.

3. NEED ANALYSIS

a) LEVEL NOW [3], WILL BE LEVEL [3] UNDER EXISTING PLANS.

b) REQUIRED ADVANCEMENT – SHOULD BE TECHNOLOGY READY AT LEVEL [7] FOR OPERATIONAL SYSTEM USE BY DATE: 1990

c) RISK IN ACHIEVING ADVANCEMENT:
HIGH [ ] MEDIUM [X] LOW [ ]

d) CRITICALITY TO THE ACCOMPLISHMENTS: ENABLING [XX] OR
ENHANCING: HIGH [ ] MEDIUM [ ] LOW [ ]

e) TASKS NEEDED: STUDY [X] ANALYSIS [X] RESEARCH [X]
GRD TEST [X] AIR CRAFT TEST [ ] SPACE FLIGHT TEST [X]
OTHER (Specify) [ ] (Check one or more)

f) R&T BASE CANDIDATE FY 78 $200K

4. COMPLEMENTARY TECHNOLOGY ADVANCEMENTS REQUIRED FOR USE OF THIS TECHNOLOGY NGC, materials, structures, propulsion, power

5. SPECIFY TECHNOLOGY ADVANCEMENT REQUIRED TO ACCOMPLISH NEED

Technology advancement in large light-weight space structures of high geometrical accuracy. Pointing and figure control of such structures, transportation to orbit, advance technology in low cost mass reproducible ground antennas and multielement, broadband arraying techniques.

LEVEL OF STATE OF ART

1. BASIC PHENOMENA OBSERVED AND REPORTED
2. THEORY FORMULATED TO DESCRIBE PHENOMENA
3. THEORY TESTED BY PHYSICAL EXPERIMENT OR MATHEMATICAL MODEL
4. PERTINENT FUNCTION OR CHARACTERISTIC DEMONSTRATED
5. COMPONENT OR BREADBOARD TESTED IN RELEVANT ENVIRONMENT IN THE LABORATORY
6. MODEL TESTED IN AIRCRAFT ENVIRONMENT
7. MODEL TESTED IN SPACE ENVIRONMENT

SPACE TECHNOLOGY NEED PRIORITY ASSESSMENT

FORM II
FORM III

(List in numerical order, 1 — Highest Priority)

WORKING GROUP E-3

DATE 4 / 29 / 76

TECHNOLOGY NEED NO. / THEME NO.		7 SPACE POWER	8 SPACE INDUST.	9 SETI	10 SOLAR SYS. EXPL.	11 GLOBAL SERVICE	12 ADV. TRANS. SYS.	NASA R&T Current	NASA R&T R&T Base	SUMMARY PRIORITY ASSESSMENT WG	TT	OAST DIV.	$ K
Alignment Sensing	07/1	1	1	X	X	X				1			
Earth Based Arrays of 100M Antennas	9/2									del-ted			
UV/Visible/IR Immaging Arrays	10/3			X	1	X	X	X	1	3		500	700
Microwave Sounding Radiometers	11/4				X	1		X	2	4		100	400
Multi-freq Micro-wave Imaging Radiometer	11/5			X	X	2			5	5			200
Plan Surf Chem Anal by Alpha P, Gam- & X-Ray Spec	10/6				2				4	6			150
Balloor Antenna (or Large Spherical)	9/7									del-ted			
Charge State Measurement	07/8	2	2							8			
Radiation Dosage Meter	07/9	3	3		X		X			9			
Large Parabolic Torus Antenna	9/10				X	X				del-ted			
Collector Capabil-ities for Remote Sample Return	10/11				3				6	11			200
Dust Analyzer	10/11A				4	X			16	11A			300
Microwave Pressure Sensor (Active MW)	11/13				X	3			9	13			250

SPACE TECHNOLOGY NEED PRIORITY ASSESSMENT

FORM II
FORM III

(List in numerical order, 1 – Highest Priority)

WORKING GROUP E-3

DATE 4 / 29 / 76

TECHNOLOGY NEED NO. / THEME NO.		7 SPACE POWER	8 SPACE INDUST.	9 SETI	10 SOLAR SYS. EXPL.	11 GLOBAL SERVICE	12 ADV.TRANS. SYS.	NASA R&T		SUMMARY PRIORITY ASSESSMENT			
								Current	R&T Base	WG	TT	C.ST DIV.	$ K
Multi-Function, Multi-Freq, Multi-Polar, MW Radar	11/14				X	4			13	14			300
High Res Imaging Spectrometer	10/15				5	X			7	15			200
Giga Channel (10^9) Spectrum Analyzer	9/16			3	X	X				16			
Solar Spectrum Measurement	07/17	4	4		X	X				17			
Portable Haz Warn Detect for Microw & LASAR Beam	07/18	5	5							18			
Low Noise Microwave Receivers	9/19			1						19			
Penetrator Sensor Development	10/20				5	5			11	20			100
Gas-Filter Correlation Radiometry	11/21				X	5			15	21			150
Laser Heterodyne Radiometer	11/22				X	6		X		22		300	250
Contain & Protect Requirements of Rem Samp Ret	10/23				6				19	23			150
Line Source for Spherical Reflectors	9/24	X			X	X				del-ted			
Magnetic Sensing	07/25	6	6		X	X				25			
1500°K Temperature Sensing	07/26	7	7							26			

SPACE TECHNOLOGY NEED PRIORITY ASSESSMENT

FORM II
FORM III

(List in numerical order, 1 — Highest Priority)

WORKING GROUP E-3

DATE 4 / 29 / 76

TECHNOLOGY NEED NO. / THEME NO.		7 SPACE POWER	8 SPACE INDUST.	9 SETI	10 SOLAR SYS. EXPL.	11 GLOBAL SERVICE	12 ADV.TRANS. SYS.	NASA R&T		SUMMARY PRIORITY ASSESSMENT			
								Current	R&T Base	WG	TT	OAST DIV.	$ K
Linear Multicolor CCD Array	9/27			5						27			
Improved X-Ray & Gamma-Ray Remote Sens of Plan Surf	10/28				7				20	28			300
Laser Absorption Spectrometry & Lidar	11/29				X	7				29			
Space Meteorological Radar (Active MW)	11/30				X	8				30			
Composition Anal of Small Solid Particles	10/31				8					31			
Radial Velocity Spectrometer	9/32			6						32			
Low Cost Electronic Subsystem Technology	01/33	8	8	X	X	X	X	X		33		500	500
Low Cost Hybrid Technology	01/34	9	9	X	X	X	X		21	34			100
Column Density Monitor	9/35						1			35			
Planet Quarant Facility in Near Earth Environment	10/36				9					36			
Advanced Atmospheric Sounding IR Radiometer	11/37				X	9				37			
Advanced Interferometer Spectrometer	10/38				16	10				38			
Thematic Mapper	11/39				X	11				39			

SPACE TECHNOLOGY NEED PRIORITY ASSESSMENT

FORM II
FORM III

(List in numerical order, 1 — Highest Priority)

WORKING GROUP E-3

DATE 4 / 29 / 76

TECHNOLOGY NEED NO. / THEME NO.		7 SPACE POWER	8 SPACE INDUST.	9 SETI	10 SOLAR SYS. EXPL.	11 GLOBAL SERVICE	12 ADV.TRANS. SYS.	NASA R&T		SUMMARY PRIORITY ASSESSMENT			
								Current	R&T Base	WG	TT	OAST DIV.	$ K
Planetary Reconn from Near Earth	10/40				10		X			40			
LSI Sensor Electronics	01/40A	10	10	X	X	X	X		10	40A			200
Mass Spectrom Meth of Surf Composition Anal	10/42				11				22	42			150
Active Microwave Subsurf Sounder & Ice Thick Sensor	11/43				X	12				43			
Ancilliary Information for Remote Sample Return	10/44				12				23	44			150
Narrow F.O.V. Limb-Scanning filter Radiometry	11/45				X	13			24	45			100
Interplanetary Observatory Telescope	10/46				13	X	X		25	46			100
Correlation Interferometry	11/47				X	14			26	47			150
Life Detection Sensors	10/48				14				27	48			300
VIS/Near IR Radiom. for AIM Scattered Radiation	11/49				X	15				49			
Scientific Analysis of Remote Sample Returns	10/50				15				28	50			100
Laser Profile for Earth Surface Movements	11/51				X	16			29	51			100
High Power LASERS /LIDAR Technology	11/52				X	17		X	3	52		80	200

SPACE TECHNOLOGY NEED PRIORITY ASSESSMENT

FORM II
FORM III

(List in numerical order, 1 — Highest Priority)

WORKING GROUP E-3

DATE 4 / 29 / 76

TECHNOLOGY NEED NO. / THEME NO.		7 SPACE POWER	8 SPACE INDUST.	9 SETI	10 SOLAR SYS. EXPL.	11 GLOBAL SERVICE	12 ADV.TRANS. SYS.	NASA R&T		SUMMARY PRIORITY ASSESSMENT			
								Current	R&T Base	WG	TT	OAST DIV.	$ K
Surf Anal by Reflective & Emmissive Spectrom	10/53				17				30	53			100
Detector (and Optics) Cooling Technology	11/54			X	X	18			12	54			200
Absorption Pumping Cryogenic Refrigerator	11/54A					X				54A			100
Gravitometer	10/55				18	X	X		31	55			100
Optical Filter Coating Technology	11/56	X			X	19			17	56			250
Rem Scan Elec Mic w/non-disp detect part. manip.	10/57				19				32	57			100
Absol Radiom Calib Technol for Solar Irrad Tech	11/58	X			X	20			33	58			50
Compos Anal of Plan Surf by Rem Sens Hi. En. Part	10/59				20					59			
Etalon Narrow-Band Filter Technology	11/60				X	21			18	60			200
In-Situ Metero-logical Status for Planet Atmos	10/61				21					61			
Non-Cryogenic IR Detectors	10/62				22	22		X	8	62		80	150
High Res Heat Flow Determination of Plan Bodies	10/63				23					63			
Sensor Supporting Technology	11/64	X	X		24	X	X			64			

SPACE TECHNOLOGY NEED PRIORITY ASSESSMENT

FORM II
FORM III

(List in numerical order, 1 — Highest Priority)

WORKING GROUP E-3

DATE 4/29/76

TECHNOLOGY NEED NO. / THEME NO.		7 SPACE POWER	8 SPACE INDUST.	9 SETI	10 SOLAR SYS. EXPL.	11 GLOBAL SERVICE	12 ADV. TRANS. SYS.	NASA R&T		SUMMARY PRIORITY ASSESSMENT			
								Current	R&T Base	WG	TT	OAST DIV.	$ K
TAOF (Wide Aperture)	10/65				25	X				65			
Fiber Optics/Integrated Optics Applications Prog	11/65A				26	23	2	X		65A		100	150
Photon Detectors for Wavelengths > 30UM	9/66			X	X	X			14	66			100
Antenna Feed Design	9/67			4						2			
Large Aperature Antennas	9/68			2						7			

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Microwave Pressure Sensor **DATE** 4 / 29 / 76

TT NO. _____ **OR WORKING GROUP NO.** E-3

OBJECTIVE
Develop an active microwave remote surface pressure sensor (1 mb accuracy) for satellite applications

JUSTIFICATION No means remote atmospheric pressure now exists. This information would be very valuable to meterologist in predicting movement and activity of severe storms and weather front.

TECHNICAL APPROACH/PLAN
Study the proposed active microwave technique for remote pressure sensing. Analyze errors and develop hardware required for shuttle sortie demonstration experiments.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Study	—	—																		
Design shuttle exp.			—	—																
Develop hardware					—	—	—													
Shuttle mission							—	—												
Design dual freq of system	—	—	—	—	—	—	—	—	—	—	—	—	—							
Devel. 1 mb system																				
MANPOWER (M-Y)																				
INHOUSE	1	1	2	3	3	5	4	3	3	3	3	3	3							
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT			.3	.5	.6	.7	.7	.8	.8	.8	.7	.7	.7							

PROPOSED LEAD CENTER GSFC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Multi-Spectral High Resolution MW Radiometer **DATE** 4 / 28 / 76

TT NO. _____ **OR WORKING GROUP NO.** E-3

OBJECTIVE
Develop multi-frequency scanning antennas and radiometers to cover 1-300 GHz

JUSTIFICATION High resolution microwave radiometers can penetrate clouds and provide images of sea temperature, sea surface wind speeds, water vapor, precipitation, pollution

TECHNICAL APPROACH/PLAN
(1) Study alternate approaches for shuttle experiments and free flyers
(2) Develop microprocessor controlled low noise radiometer 1-300 GHz
(3) Conduct aircraft experiments and develop inversion algorithms
(4) Develop 2-3 M shuttle based antenna systems (1-300 GHz) in phases
(5) Develop free flyer antenna/radiometer

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK (1)																				
(2)																				
(3)																				
(4)																				
(5)								▲				▲				▲				
MANPOWER (M-Y) OUSE			8	9	9	10	10	10	10	10	10	10	10							
ITRACT																				
FUNDING (10^6 $) INHOUSE			.3	.4	.4	.5	.5	.5	.5	.6	.6	.6	.6							
CONTRACT																				

PROPOSED LEAD CENTER GSFC/LaRC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Advanced Microwave Sounding Radiometers (Near-Nadir and Limb) **DATE** 4 / 29 / 76

TT NO. _____ **OR WORKING GROUP NO.** E-3

OBJECTIVE
To provide near all weather, high spatial resolution atmospheric and pollution sensing from geosynchronous orbit

JUSTIFICATION The 118 GHz O_2 line and 183 GHz H_2O line will provide critical temperature and precipitation maps of severe storms under the circus canopy which limits the IR sensors.

TECHNICAL APPROACH/PLAN
Millimeter and submillimeter radiometers must be developed over the 100-1000 GHz frequency range and aircraft experiments flown to develop the inversion algorithms. Shuttle experiments of selected bands on sortie mission should follow aircraft missions prior to free flyer mission.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Theory/experim'ts	—	—	—	—	—	—	—	—	—	—	—	—	—							
Mission studies		—	—		—			—												
Sensor definition			—		—	—		—	—											
Aircraft demo.			▼		▼		▼		▼		▼		▼							
Sensor developm't		—	—	—	—			—	—	—			—	—	—	—				
MANPOWER (M-Y)																				
INHOUSE	3	3	3	3	3	3	3	3	3	3	3									
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE	.05	.15	.4	.6	.7	.7	.8	.8	.8	.8	.8	.8	.8	.8	.8					
CONTRACT																				

PROPOSED LEAD CENTER GSFC/JPL

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Multi-Function Multi-Frequency Multi-Polarization Microwave Radar **DATE** 4 / 28 / 76

TT NO. _____ **OR WORKING GROUP NO.** E-3

OBJECTIVE
To combine in a single sensor multiple mode capability of a radar altimeter, scatterometer and imaging radar

JUSTIFICATION The basic imaging radar provides spatial resolution comparable to LANDSAT images. However, calibration techniques are required so that accurate power vs time measurements can be made for altimetry and scatterometry.

TECHNICAL APPROACH/PLAN
(1) Perform study to define sensor application needs
(2) ART/SRT critical subsystems
(3) Develop techniques for on-board processing to obtain ocean spectra, radar cross-section, altitude

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
(1)		—	—																	
(2)			—	—	—	—														
(3)					—	—	▽		▽		▽									
MANPOWER (M-Y)																				
INHOUSE		1	1	4	4	4	4	4	4	4	4									
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE			.3	.3	.3	.4	.4	.4	.4	.4										
CONTRACT																				

PROPOSED LEAD CENTER GSFC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Containment and Protection Requirements of Remote Sample Return **DATE** 4/27/76

TT NO. 10 **OR WORKING GROUP NO.** E3

OBJECTIVE
Specified containment and return of collected material to present degradation of scientific information.

JUSTIFICATION Surface samples from planetary bodies will be returned to Earth for study. They must be returned in sealed containers and protected from the space and earth environment.

TECHNICAL APPROACH/PLAN
Develop reliable vacuum sealing containers constructed of non-contaminating materials. Sensors for monitoring and control of pressure, temperature and radiation environment during sample return. Facilities for receipt and processing of sample on earth or near-earth environment must be considered.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Vacuum container		⊢	—	—	—	—	—													
P,T monitoring		⊢	—	—	—	—	—													
Radiation shielding		⊢	—	—	—	—	—													
Sample Receipt					⊢	—	—	—	—	—										
MANPOWER (M-Y)																				
INHOUSE																				
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER JSC, JPL, Ames

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Ancillary Information for Remote Sample Return **DATE** 4 / 27 / 76

TT NO. 10 **OR WORKING GROUP NO.** E3

OBJECTIVE
Determine specified characteristics of samples and samples environment prior to and during collection.

JUSTIFICATION In support of remote sample return missions, ancillary information about the sample and its landing site is required.

TECHNICAL APPROACH/PLAN
Develop ability to image sample during collection, Check capability to measure the local meteorology. Perform basic chemical analysis of landing site (e.g. X.R.F. on alpha-particle experiment) and determine petrographic properties of soil.

SCHEDULE

SCHEDULE ITEM	FY 76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Imaging			⊢	—	—	—	—	—												
Metoerology			⊢	—	—	—	—	—												
Chemical element analysis			⊢	—	—	—	—	—	—	—										
Soil physical properties			⊢	—	—	—	—	—												
MANPOWER (M-Y) INHOUSE CONTRACT																				
FUNDING (10^6 $) INHOUSE CONTRACT																				

PROPOSED LEAD CENTER JPL, ARC, JSC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Scientific Analysis of Remote Sample Return Material **DATE** 4 / 27 / 76

TT NO. 10 **OR WORKING GROUP NO.** E3

OBJECTIVE
Scientific analysis in individual laboratories of remote sample return utilizing state-of-the-art analytical capabilities.

JUSTIFICATION The maximum scientific return and information available on planetary materials can be obtained in laboratories using the state-of-the-art techniques.

TECHNICAL APPROACH/PLAN
SR&T support for the analysis of extraterrestrial materials must be initiated. Basic geochemical and geophysical analyses of returned samples.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Analysis of Extraterrestrial Materials																				
MANPOWER (M-Y)																				
INHOUSE																				
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER JSC, ARC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Planetary Quarantine Facility in Near-Earth Environment **DATE** 4 / 27 / 76

TT NO. 10 **OR WORKING GROUP NO.** E3

OBJECTIVE

Develop facility for carrying out preliminary examination of returned remote samples under quarantine constraints.

JUSTIFICATION Samples from planetary objects will be returned to earth for study. A facility for their preliminary examination - under quarantine control -must be available.

TECHNICAL APPROACH/PLAN

Document criteria for definition of suitability of sample (safe) return to earth. Develop techniques for sterilization of a limited portion of the returned sample. Develop capability for facility to perform limited preliminary scientific study of sample.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Sterilization			⊢	—	—	—	—	—												
Isolation Facility			⊢	—	—	—	—	—	—	—										
Non-harmful criteria			⊢	—	—	—	—	—	—	—										
MANPOWER (M-Y)																				
)USE																				
ITRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER Ames, JSC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Planetary Surface Chemical Analyses by Alpha-Particle, Gamma-ray and X-ray ~~Spectrometry~~ **DATE** 4 / 28 / 76

TT NO. 10 **OR WORKING GROUP NO.** E3

OBJECTIVE

Develop methods of spectrometric analysis for planetary surface study.

JUSTIFICATION Analysis instruments must be available for Landers and return sample missions to planetary surfaces in order to measure chemical composition of the body.

TECHNICAL APPROACH/PLAN

Development of flight-qualified instruments for in-situ chemical analysis of planetary surfaces using the techniques of alphaparticle, gamma-ray and x-ray spectroscopy. Develop technique of remote activation analysis by means of a thermal neutron source.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Alpha particle																				
X-ray spectrometry																				
Gamma-ray spectrometry																				
Neutron source																				
MANPOWER (M-Y) INHOUSE / CONTRACT																				
FUNDING (10^6 $) INHOUSE / CONTRACT																				

PROPOSED LEAD CENTER JPL, JSC, Ames, GSFC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Improved X-Ray and Gamma-Ray Remote Sensors for Planetary Surfaces **DATE** 4 / 27 / 76

TT NO. 10 **OR WORKING GROUP NO.** E3

OBJECTIVE
Develop improved x-ray and gamma-ray detectors for remote orbital measurements of the composition of planetary surfaces.

JUSTIFICATION Orbital space probes will visit the planets in the near future. Instruments for remote chemical sensing of the surface must be develc ı and improved to carry out remote planetary geoscience.

TECHNICAL APPROACH/PLAN
Develop greater spectral resolution of x-ray and gamma-ray detectors. Develop technology for greater surface spatial resolution. Understand calibration and interferences.
Determine long term irradiation effects on detectors.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
X-ray		———	———	———	———															
Gamma-ray		———	———	———	———															
MANPOWER (M-Y)																				
)USE																				
/TRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER JPL, GSFC, JSC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE — FORM IV

TITLE Mass Spectrometric Methods of Surface Compositional Analysis — DATE 4 / 28 / 76

TT NO. 10 — OR WORKING GROUP NO. E-3

OBJECTIVE
Develop improved mass spectrometer methods of analysis which are applicable for planetary surface materials.

JUSTIFICATION Spacecraft will soft land on planetary bodies in the future. Analysis equipment to support - planetary geoscience studies is required.

TECHNICAL APPROACH/PLAN
Develop improved flight qualified mass spectrometers with high sensitivity, high resolution for 1 to 200 amu range. Develop required ionization sources for analysis of solid samples. Upgrade GC-MS and develop other methods of analysis involving interfacing with mass spect.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Mass Spectrometer		←	—	—	—	→														
Ionization sources		←	—	—	—	—	→													
Fractionation Tech.		←	—	—	—	—	→													
Interfacing Tech.		←	—	—	—	—	→													
Data Reduction		←	—	—	—	—	→													
MANPOWER (M-Y)																				
INHOUSE																				
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER JPL, JSC, Ames

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE High Resolution Heat Flow Determination on Planetary Surfaces **DATE** 4/27/76

TT NO. 10 **OR WORKING GROUP NO.** 3E

OBJECTIVE
Develop technique and detectors to measure temperature profile as a function of subsurface depth to enable determination of local heat flow.

JUSTIFICATION Lander and penetrometer missions to planetary objects require the measurement of the objects heat flow.

TECHNICAL APPROACH/PLAN
Develop technology of temperature sensors to monitor temperature profiles on a planetary body. Develop methods for emplacement of sensors at depths of 1 to 5 meters on solar system objects.

SCHEDULE

FY / SCHEDULE ITEM	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Sensor development			├	—	—	—	┤													
Implementation Study			├	—	—	—	—	—	┤											
Calibration Study			├	—	—	—	—	—	┤											
MANPOWER (M-Y)																				
INHOUSE																				
CONTRACT					·															
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER JSC, JPL

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Compositional Analysis of Small Solid Particles (Comets) **DATE** 4 / 28 / 76

TT NO. 10 **OR WORKING GROUP NO.** E-3

OBJECTIVE
Develop capability to determine chemical composition of small solid particles in space, especially those with high encounter velocities.

JUSTIFICATION One of most important measurements to be made on a comet fly-by or rendezvous is chemical analysis of solid dust and ice particles. No technical means now exists for this measurement.

TECHNICAL APPROACH/PLAN

1. Develop instrumentation to determine relative abundances of major chemical elements in dust and ice particles of ~ 1-1,000 microns encountered at velocities up to ~ 20 km/sec.
2. Support instrumentation development to better measure composition of cosmic dust particles (meteoroids) which enter Earth's atmosphere.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Instrumentation for Cometary Materials			═	═	═	═	═	═												
Micrometeorites			═	═	═	═	═	═												
MANPOWER (M-Y) INHOUSE																				
CONTRACT																				
FUNDING (10^6 $) INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER JSC - JPL

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Remote Scanning Electron Microscope (SEM) With Analysis Detector and Particle (1 to 5 micron) Manipulator **DATE** 4 / 27 / 76

TT NO. 10 **OR WORKING GROUP NO.** 3E

OBJECTIVE

Method for characterizing grain sizes and compositions of planetary surfaces.

JUSTIFICATION

Landers will perform analysis on planetary objects and data on grain sizes and compositions are required.

TECHNICAL APPROACH/PLAN

Develop flight qualified Scanning electron microscope with non-dispersive analyzer. Instrument must have ancillary equipment for particule manipulation (size 1 to 5 microns) and control.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
SEM			├	─	─	─	─	─	┤											
X-ray detectors			├	─	─	─	┤													
Sample manipulator			├	─	─	─	┤													
MANPOWER (M-Y)																				
INHOUSE																				
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER JPL

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Life Detection Sensors **DATE** 4 / 27 / 76

TT NO. 10 **OR WORKING GROUP NO.** E3

OBJECTIVE

Develop methods for detecting life via remote analysis.

JUSTIFICATION

Future exploration of the solar system requires that we have methods of analysis for detection of life available for those planetary bodies which might support life.

TECHNICAL APPROACH/PLAN

Develop flight qualified instruments for life detection (auto-microscope, culture capability, immunological testing), upgrading GC-MS, development of Unified Biology experiment, and water detectors.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
1. Life Detection Expt.																				
a. Microscope			———	———	———	———	———	———	———											
b. Culture ability			———	———	———	———	———	———	———											
c. Immunology			———	———	———	———	———													
2. GC-MS			———	———	———	———	———													
3. Unified Biology			———	———	———	———	———	———	———											
4. Water Detectors			———	———	———	———	———													
MANPOWER (M-Y)																				
INHOUSE																				
CONTRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER Ames, JPL, JSC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE In-situ Metoerological Station for Planetary Atmospheres **DATE** 4 / 27 / 76

TT NO. 10 **OR WORKING GROUP NO.** 3E

OBJECTIVE
Measure micrometeorology on planetary surfaces in support of in-situ studies by landers, probes and returned sample.

JUSTIFICATION For characterization of the physical environment in which remote chemical studies are made a understanding of local meteorological is required.

TECHNICAL APPROACH/PLAN
Upgrade Viking meteological station for operation on other planets, satellites and bodies.

SCHEDULE

SCHEDULE ITEM (FY)	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Design Study																				
Prototype																				
Flight Instrument																				
MANPOWER (M-Y)																				
)USE																				
ITRACT																				
FUNDING (10^6 $)																				
INHOUSE																				
CONTRACT																				

PROPOSED LEAD CENTER JPL, Ames

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT

SPACE TECHNOLOGY ADDITIONAL INITIATIVE **FORM IV**

TITLE Surface Analysis by In-Situ Reflective and Emissive Spectroscopy **DATE** 4 / 27 / 76

TT NO. 10 **OR WORKING GROUP NO.** 3E

OBJECTIVE
Analyze optically surfaces of planetary objects for their mineralogy and geology at high spatial Resolution.

JUSTIFICATION Improvements in spatial resolution required for infrared imaging systems and cameras for operation on planetary surfaces.

TECHNICAL APPROACH/PLAN
Development of zoom lens with filters which permit measurements in the reflective region (0.4 - 1 Micron) and in the thermal emissive region (3-20 Microns).

SCHEDULE

SCHEDULE ITEM	FY 76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
TASK																				
Thermal IR Multispectral Imager																				
Multispectral Facsimile Camera																				
MANPOWER (M-Y) INHOUSE CONTRACT																				
FUNDING (10^6 $) INHOUSE CONTRACT																				

PROPOSED LEAD CENTER JPL, JSC, GSFC

RECOMMENDATIONS FOR FULLER DEVELOPMENT OF INITIATIVE STATEMENT